QU. 5877

DEPARTMENT

— OF —

COLONIZATION, MINES & FISHERIES

MINING OPERATIONS

— IN THE —

PROVINCE OF QUEBEC

FOR THE YEAR

1908

— BY —

J. OBALSKI, M.E.

SUPERINTENDENT OF MINES

QUEBEC,
PRINTED BY CHARLES PAGEAU,
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HON C. R. DEVLIN,

Minister of Colonization, Mines and Fisheries,

Quebec.

SIR,

I have the honor to submit my report for the year 1908. Besides general information on the mining operations and statistics, it contains a report of an exploration to Chibougamau and another on the region at the head of the rivers Manikuagan and Outardes.

It is accompanied by a map of the asbestos region of Broughton and one of the township of Ascot and the environs of Sherbrooke.

Notwithstanding the financial crisis and the fall in the price of metals, last year, our mining industry has continued to progress and the output of our mines this year was $5,493,664 as against $5,019,932 in 1907.

I have the honor to be,

Sir,

Your obedient servant,

J. OBALSKI,

Superintendent of Mines.

Quebec, February, 1909.

Mining Operations

IRON

Iron metallurgy in the province of Quebec is now controlled by the *Canada Iron Corporation, Ltd.*, of Montreal, which has purchased the plant and business of the Canada Iron Furnace Company, Ltd., operating at Radnor and of John McDougall & Co., operating at Drummondville.

This same company also operates iron mines and blast furnaces in Nova Scotia, New-Brunswick and Ontario. The blast furnaces of Drummondville and Radnor were in regular operation, bog ore being almost exclusively used.

The results were as follows:

Ore charged..	15,493 tons of 2,000 lbs	worth..	$ 60,020
Limestone charged.. ..	2,887 " "	" ..	1,337
Charcoal..	977,840 bushels of 20 lbs	" ..	85,738
Pig iron produced.. ..	5,989 gross tons	" ..	171,286
corresponding to. .	6,708 tons of 2,000 lbs.		

Henceforward, the two furnaces of Drummondville and that of Radnor will therefore be operated by the same company. At Drummondville, bog ore and charcoal are exclusively employed, while at Radnor, besides the bog ore, magnetic iron from Ontario and ore imported from the United States are used; consequently, the latter furnace only consumed 4,426 tons of bog ore. Coke is also used in equal proportion to charcoal.

The furnaces use hot air. The ore is taken out by the companies or obtained from the inhabitants or from small contractors. The limestone is extracted in the neighborhood and the charcoal is manufactured on the spot in close kilns, using the wood of the region.

Thse magnetic sands of the North Shore are still the subject of experiment. Some experimenters are striving to secure direct smelting and reduction by the electric furnace to make steel, while others confine themselves to agglomerating the sands previously concentrated so as to get a very pure ore carrying 68 to 70 p. c. of metallic iron and capable of being treated by blast furnace. Experiments of the first class have been made under the auspices of the Federal Government, which attest the value of the process, but do not seem to demonstrate its industrial utility. In the second class of experiments is the smelting of the ore by the electric furnace by letting it fall between the two electrodes of a furnace in which it is sufficiently heated to melt partly and

to agglomerate. The same effect is obtained by the Grondal process, which consists in heating the ore to agglomeration in chambers, utilizing the waste gases of the blast furnaces . The latter process, which is employed successfully in Norway, might, without doubt, be made applicable to our sands. In any case, nothing definite has yet been done on the subject.

There is nothing new to note with respect to our other iron ore deposits.

Three parties of explorers have visited the upper part of the river Manikuagan on the North Shore. One of these was sent out by the Department and its report will be found further on. The object of these explorations was to locate a deposit of magnetite and hematite, mentioned in the reports of Mr. A. P. Low, director of the Geological Survey and which he considered of great importance. The reports of the explorers were not ve y satisfactory. They found only small quantities of iron ore impregnating what were apparently Laurentian rocks.

In the Lake Megantic region, prospecting licenses were granted on lands said to contain large quantities of hematite, but we know nothing definite yet on these discoveries.

There is nothing new either with regard to our deposits of titanic iron.

OCHRE

The working of ochre at St. Malo and Champlain, in the neighborhood of Three Rivers, has been continued by three companies: Canada Paint Company, Champlain Oxyde Company and S. W. Argall, with practically the same results.

The output for 1908 was 1,500 tons of crude ochre, worth $4,500 and 1,346 tons of calcined and ground ochre worth $15,440.

The working was carried on for about 7 months of the year and gave employment to 61 hands, who received $12,597 in wages.

The crude ochre is partly employed for the purification of illuminating gas, while the prepared product serves to make paint and is in great part utilized for that purpose in Montreal, whence in its final form it is distributed through the different parts of Canada and the United States.

CHROME

During the past year, there were only two mines in operation, that of the Dominion Chrome Company, at Little Lake St. Francis, and that of the Black Lake Chrome and Asbestos Company, at Black Lake. These two prop-

erties are moreover under the same management. At these two points the concentration mills worked during seven to ten months of the year.

The other mills and mines of the American Chrome Company and the Canadian Chrome Company were idle, but it is probable that these works will resume operations in 1909.

A new Company, the "*D'Israeli Chrome Mines, Ltd.*", has been organised to work lot V. 37 of Garthby, the property of Mr. O. Brousseau. A couple of car loads were shipped and it is proposed to establish a concentration mill there. The demand for chrome is pretty good and the prices satisfactory; an improvement in this industry may therefore be looked forward to in 1909.

Some prospecting was also done in Coleraine and Bolton townships which will justify development work.

The production in 1908 was as follows in long tons:

2nd class in lumps..	3754	tons worth..	$38,740
Concentrates.	3000	"	45,000
Total..	6754	"	$83,740

Corresponding to 7564 tons of 2,000 lbs.

70 men receiving $32,000 in wages, were employed during about one half of the year.

COPPER

The copper market during the year was so irregular that any great development of our mines was not to be expected. At Capelton, the Eustis mine alone was in operation this year with the usual results, the debris being treated in the concentration works near the railway.

The Nichols Company's mines were shut down and we see that they are now figuring under the name of a new company, the *Albert Copper Company*. These mines were not worked this year. The manufactory of sulphuric acid and chemical products, however, continues its operations, using the ores from the Eustis mines and other sulphurous ores coming from Ontario.

I visited the Suffield mine opened by Mr. E. O. Norton, in the township of Ascot.

The works were carried on during the whole year and several thousand tons of ore were extracted and heaped around the mine. The mine itself consists of an inclined shaft of about 45°, with a depth of 400 feet and a drift at

the depth of 200 feet. In all these workings, the ore is in sight, now in the form of copper pyrites in small masses or veins and now disseminated through the rock which is a quartzose talco-schist. The walls of this deposit have not been reached, but it appears to be of pretty large dimensions, seeing that the shaft itself has a width of 10 feet, which would seem to indicate the presence of a considerable mass of low grade ore.

I avail myself of the occasion to draw attention to the fact that, in our Eastern Townships, our copper deposits deserve to receive greater development. In the report of the Geological Survey for 1866, about 400 properties are mentioned on which copper has been found and of these only two are actually being worked. Prospecting work has been done from time to time, but when a certain quantity of ore has been taken out, they do not know what to do with it, for a market for it has to be sought far off. If a smelter was established at a central point in the Eastern Townships, the small operators could send their ore to it, and get its money's worth, which would enable them to continue their undertakings and new mines might thus be opened. Moreover, for a long time, attention was only given to high grade ores, while at present ores carrying 1½ per cent of copper and less than $2 worth of gold to the ton are treated in British Columbia. We have old mines which contain copper ores disseminated through the rock, thus forming great masses, which would gave us an appreciable return. It would therefore be very desirable to establish a smelter which would have a powerful effect upon the development of these mining regions.

There was some prospecting, but no important work done in the Eastern Townships this year.

The Ascot mine was not worked this year, nor the Lake Memphremagog mine. The latter, however, has changed hands and will doubtless be developed in 1909.

The indications of copper noted in the township of Fabre at Temiscamingue in North Pontiac, and at Chibougamau were only slightly prospected or not at all. Some prospecting was done at the Matane mines and in Matapedia, county of Bonaventure.

The copper ore shipped this year amounted to 26,598 tons of 2,000 lbs. worth $159,588. The number of men employed was 122, who worked during the whole year and received $50,030 in wages.

LEAD, ZINC, COBALT, SILVER

No important work was done on the deposits or indications of these ores mentioned in preceding reports. In the township of Fabre, indications of

cobalt and of silver have been found, the details of which will be seen in a subsequent chapter and some important prospecting work has been done upon them.

GOLD

No work was done in Beauce or at Dudswell. At Lake Megantic, the Marsboro Gold Fields Company, continued to sink a shaft on lots V, 19-20 of Marston. A depth of 50 feet has been reached and industrial tests are actually being made on the quartz. The company will continue its works and make tests on a larger scale.

In May, I visited these works with Mr. E. R. Faribault, of the Geological Survey, Ottawa. Mr. J. A. Dresser, of the same survey, also visited them and has published a report on the subject.

My conclusions, which are supported by the two geologists mentioned, are the same as those I expressed in my preceding report: "The main point being to ascertain whether the gold will be disseminated in workable quantity all through the mass of the bearing rock." Other prospects were made in the neighborhood on analogous formations, but without notable results and most of the prospecting licenses taken out in this region have been abandoned.

In the township of Compton, studies were made with the aid of boring machines on large gravel deposits in the valley of the Moe's river, the results being important enough to justify the organization of a company, *The Compton Gold Dredging Company*, which proposes to work these deposits by means of dredges. This method has not yet been employed in our province and we await the results of the works before expressing an opinion upon it.

In the township of Ditton, near the little Salmon river, borings were also made and appear to have given satisfactory results.

In North Pontiac, the Pontiac and Abitibi Gold Mines Company has continued its searches and proposes to establish machinery and mills on the property which is situated in the proposed township of Boischatel. This winter the company has built a road to transport its materials. This road runs from the mine to the north of Larder lake in Ontario and then connects with the Government road of that province leading to the Boston station of the Temiscamingue and Northern Ontario R. R. A certain number of prospecting licenses have remained in force in the same region and some prospecting has been done, but without notable results.

ASBESTOS

The work on existing asbestos mines was continued during the year with the same good results.

At Thetford, the four mines: Bell, King, Johnson and Beaver, were in regular operation throughout the year and there is nothing special to note with the exception of some improvements and additions to the mills and mining plant.

The Bell mines are now owned by the *Keasbey and Mattison Company* of Ambler (Pennsylvania) but are still worked in the same manner and are known as the Bell Asbestos Mines.

The Beaver Asbestos Company has a new electric plant and has erected many stores and additions to the existing buildings.

The *Thetford Asbestos Exploration Company*, on lot 28, range VI of Thetford, which has been idle for some years, is preparing to work.

In the township of Thetford, prospects are being made on the continuation of the serpentine belt and in a few places sufficient asbestos has been found to justify work being done.

The *Robertson Asbestos Mining Company* prospected on lot IV, 16, situate three quarters of a mile from the Quebec Central Railway and about three miles from Robertson station. Several excavations have been made and small veins of asbestos are seen, about half an inch and over with fibrous rock good for milling. The company has decided to put up a mill which is being built on the eastern corner of that lot. Other buildings have also been erected and a good road made to the railway.

Some good prospects have also been made on lot IV, 17, where asbestos as much as an inch long has been found. There is also a vein of chrome iron on that lot.

The Labonté mine is on lot V, 9. A cutting 30 by 20 feet and 40 feet deep has been made by hand at its extremity where many veins of asbestos from one quarter to an inch and a half may be seen. Some tons of second class crude have been got out and they are now at the mine. It is proposed to develop that property and to put up a mill later on.

A little prospecting was also done on lot V, 10, with good results.

On lot V, 2, some slight excavations have been made on a schistous serpentine containing fibre and similar to that of Broughton. This mine was bought from the Crown by Mr. Nap. Morin.

At Black Lake, the American Asbestos Company which controls 800 acres of land has changed its name and is now known as the *British Canadian Asbestos Company, Limited.* Work is being continued elsewhere under the same management and with the same success, fresh additions having been made to the plant.

The Johnson and Standard, and the Union Mine Companies worked both mines and mills throughout the year.

The Union Mine which has stopped working for several years, resumed work. That company does not ship its crude asbestos but runs it all through the mill and prepares a special quality of fibre.

The Reed mine, range B of Colraine was not worked.

The Dominion Asbestos Company, Limited, is a new company operating on a portion of the territory ceded by the Standard Asbestos Company and to the south-east of the latter. Excavations have been made on the hill of Black lake with good results and the company has put up a mill which has already treated a certain quantity of rock as a test, but which will not be in regular operation until the spring. This mill consists of a four story building 120 × 60 feet with cement foundations, the roof and faces being covered with asbestos boards as are also the other buildings. A special building 32 × 72 feet contains a large jaw-breaker and two other duplex crushers of smaller size, as well as cylindrical driers. A belt conveyer carries the rock, so dried and crushed, a distance of 100 feet to a large hopper from which it is distributed to the mill. The machinery of the mill comprises a pair of crushing rollers 24 × 40 inches, capable of crushing 25 tons per hour at the minimum; two pairs of rollers 15 × 30 inches in the third story and two others of the same dimensions on the second story. Four special defiberizing machines are placed on the first and second stories . There are also 10 circular fibre collectors 8 feet in diameter and 12 feet high for collecting the fibre and two asbestos separators.

All these apparatus are connected and accompanied by the usual accessories : elevators, suction fans, shaking screens, etc.

The whole plant has a capacity of 500 tons of rock per 20 hours but, owing to the dimensions of the mill, that capacity might be increased by putting additional plant in it.

The machinery is driven by electricity supplied by the Shawenegan company by means of a hundred horse-power motor for the crushing and drying, one of 300 horse-power for the mill and one of 10 horse-power for the belt conveyer.

A new company, the *Imperial Asbestos Company, Limited*, has recently been organized to mine on a lot of land situate south-west of Black lake on block A of Colraine and acquired from the Black Lake Chrome and Asbestos Company. That lot covers the prospects formerly made near the Quebec Central Railway and known as the Laurier Mine. No work has been done yet but it will soon be begun and a mill will be put up.

In Wolfestown, the Asbestos Mining and Manufacturing Company abandoned its work during the summer. The Colraine Asbestos and Exploration Company, and the Premier Mining Company which worked near the Colraine station, were not in operation this year.

In Garthby, the d'*Israeli Asbestos Company*, prospected on lot IV, 16, a schistous serpentine containing fibre. The company intends to develop that property which is 4 miles from the d'Israeli station and to build a mill and a branch line of railway connecting it with the Quebec Central Railway.

A certain amount of development has taken place in the Broughton region in consequence of the good demand for fibre. Several companies have been organized; mills have been built and five will be in operation in 1909. The Shawenegan Electric Company has put a line which will supply power to those companies. The result has been the creation of an important centre of population at East Broughton.

The schistous serpentine of that region yields but little crude asbestos and the greater portion of the rock is sent to the mills for the production of fibre.

The companies having mills which worked this year are the Broughton Asbestos Fibre Company, Quebec Asbestos Company, Eastern Townships Asbestos Company, Boston Asbestos Company. The latter worked in the mill for tests only at the end of the year. The Broughton Asbestos Fibre Company is about to replace steam by electricity for its works.

The Boston Asbest pany completed the building of its mill about the month of October and made some satisfactory trials which produced a small quantity of good fibre.

The mill is situate about the middle of the lot near the line of the Quebec Central Railway and consists of a building 105 by 55 feet, 68 feet high, besides other accessory buildings for the boilers, engines, crushers and driers.

The machinery of the mill is worked by two boilers of 125 horse-power, supplying a tandem Corliss engine from the Jenckes Machine Company with a capacity of 450 horse-power. A special 200 horse-power engine is used for the driers, crushers and elevators.

The mill contains a Blake breaker, a Sturtevant crusher, two Jumbo beaters, two cyclones (another is to be put in). All these are connected and accompanied by hoists, shaking screens, suction fans, store-rooms and machines for sorting the fibre.

The mill is built for a capacity of 300 tons per 20 working hours.

The company has opened excavations to the north-west of the property where a 125 horse-power boiler has been placed, which drives a hoisting drum and a cable derrick; these connect with the mill by an elevated tramway.

The rock treated in this mill comes from the *Normandin mine*, situate in the northern corner of lot V, 13a. An excavation some 40 feet in diameter and from 25 to 30 feet deep has been made in schistous serpentine, and an abundance of very fine white fibre has been found which gives a good yield in the mill. A 150 horse-power boiler, two steam hoisting drums and three boom-derricks have been put up there. The mine is about 600 yards from the line of the Quebec Central Railway and a mile and a half from East Broughton station. It is intended to build a tramway 3,000 feet long to connect it with the mill of the Boston Company.

In the eastern corner of lot V, 12b, Mr. Carrier has done a little work near the Normandin mine, in which a small quantity of good crude asbestos has been found.

Other prospects have also been made on the same belt of serpentine, especially on the lots S.W. of IV 13a, Roy mine ; N.E. of IV, 13a ,13c, Miller mine; IV N. E. 13e, Vallée mine; IV S. W. 13e, Vachon mine.

The Frontenac Asbestos Company has done surface prospecting on lot VI 13a and continues the building of a mill of great capacity. A branch railway a few hundred yards long has also been built to connect the railway with the Quebec Central. The mill will be in operation at the beginning of 1909 and will be driven by electric power supplied by the Shawenegan Water Power Company.

The *Champlain Asbestos Company* was organized during the year to work on lot VIII 13, where good indications of fibrous serpentine have been found. So far, some prospecting only has been done on this lot.

Some prospecting was also done on the Tanguay mine VII, 13e, 13f and also by Mr. Angers on lots VII, 13h, 13i,. It is proposed to re-open the Fraser mine, VII, 14a.

To this report is annexed a map of the asbestos region of Broughton

township on a scale of 20 chains to the inch, showing the situation of the mines above mentioned.

At Danville, the Danville Asbestos and Asbestic Company continued its operations with the same success; the production was very considerable and still further additions will be made to the mill.

In the township of Bolton there is a belt of serpentine in which the presence of asbestos has been detected for a long while, but attention has been paid to it only of late years. Some prospecting was done two or three years ago on a hill of serpentine situate on lot VII N. ½ 11 of Bolton and fibrous rock was discovered with veins of crude asbestos of good dimensions. During the year the *Brome County Asbestos Development Company*, of Montreal, obtained control of that property and of others in the vicinity and it proposes to develop them by putting up a mill. The mine is 4 miles from Eastman on the Canadian Pacific Railway and a mile from the Missisquoi Valley Railway. Prospecting was also done on other lots of the same region with variable results :

No work of any importance was done in Beauce, or in the county of Ottawa or at Chibougamau and it is not to our knowledge that any noteworthy discovery of asbestos has been made in other parts of the Province.

To sum up, the asbestos industry has given good results this year, especially if we consider the general depression in business during the past year. The fresh uses found for asbestos, especially the manufacture of asbestos boards, has increased the demand for fibre which is mixed with cement or magnesia for that purpose. This explains the organization of new companies and the building of mills in regions where little or no crude asbestos is found. Prospecting is being carried on in other parts of the Province with the same view.

The production for 1908 was as follows:

First class crude..	900	tons, worth..	$ 261,216.00
2nd " "	2,771	" "	438,305.00
Fibre..	13,911	" "	716,811.00
Paper stock..	47,574	" "	1,135,264.00
Total..	65,157	" "	$2,551,596.00
Asbestic..	24,011	" "	34,660.00
		Total value..	$2,577,302.00

Workmen to the number of 4284 and receiving $1,066,774 in wages, worked the greater part of the year. It may thus be seen that, notwithstand-

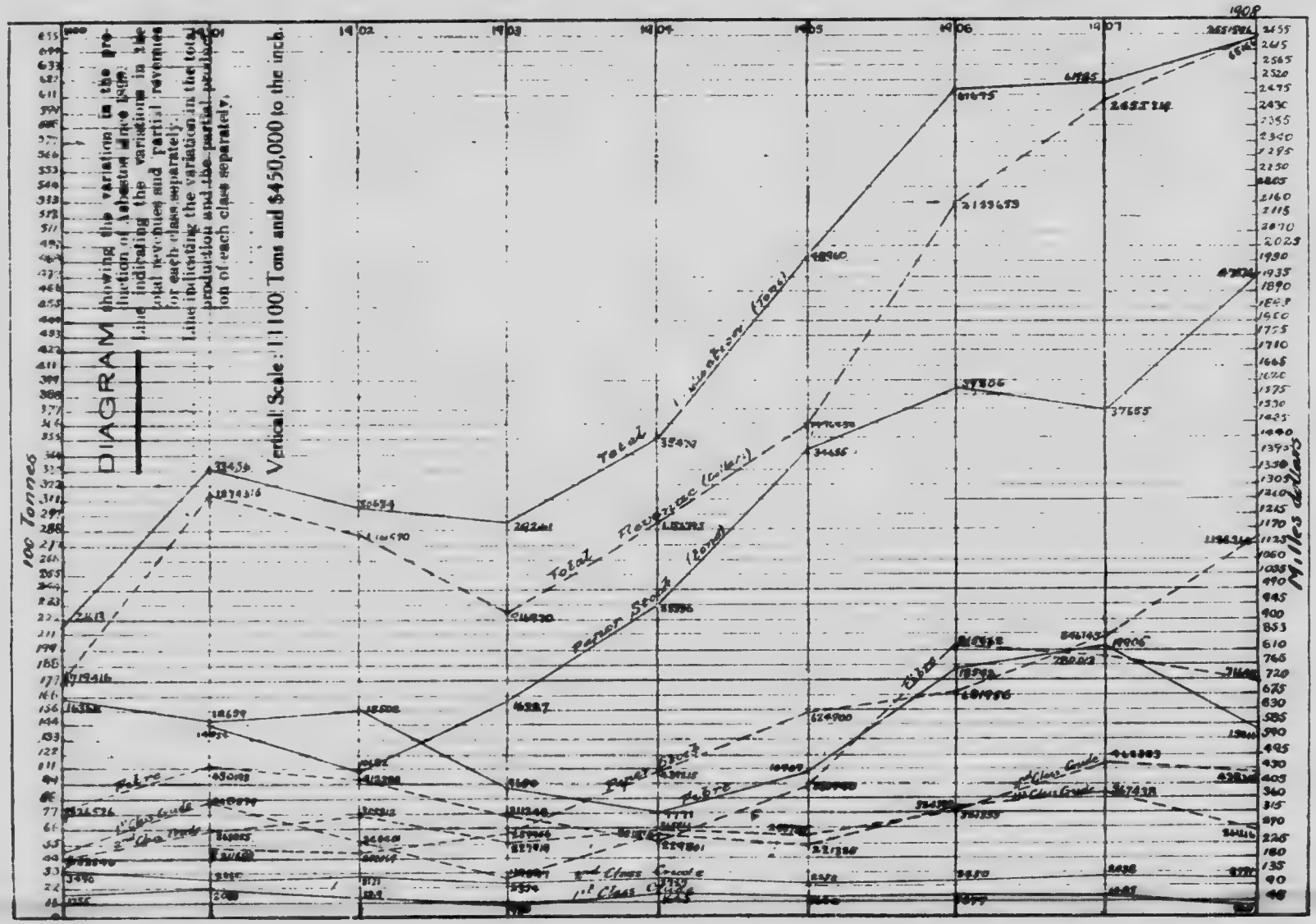
DIAGRAM showing the variation in the production of Asbestos since 1900.
Line indicating the variations in the total revenues and partial revenues for each class separately.
Line indicating the variation in the total production and the partial production of each class separately.
Vertical Scale : 1:1100 Tons and $450,000 to the inch.
100 Tonnes
Millions dollars
1901
1902
1903
1904
1905
1906
1907
1908
Total production (Tonnes)
Total revenue (Dollars)
Paper Stock (Tonnes)
Fibre
Paper Stock
Fibre
1st Class Grade
2nd Class Grade
3rd Class Grade

ing unfavorable conditions, the production and value have increased, the additional quantity being chiefly due to paper stock.

Progress is being made in the asbestos industry in Russia and, owing to the low price of labour and the protection given by the Government by lowering transportation rates, the asbestos of that country may enter into strong competition with ours. Thus, in 1907, about 10,000 tons of asbestos were got out in the Ural region.

MICA

But little work was done in the mica mines during the year and the market was bad. The uses to which it is put are still the same, but there was less demand for it from the factories. There was but little activity in the trimming shops in Ottawa; a few mines only were worked and shipped mica, amongst which may be mentioned those of Blackburn Brothers, H. E. Flynn, Kent Brothers, W. Argall, Calumet Mining Company. Some other mine owners have taken out mica but have shipped none. Thus a good quantity remains on hand for next year's shipments.

We have been unable, this year, to get the details of the dimensions of the mica shipped, but the aggregate shipment of thumb trimmed mica was 106 tons, worth $95,311. The number of men employed was 184; they worked for periods of from 6 to 12 months and received $47,724 in wages.

No products were got out of the white mica mines.

PHOSPHATE OF LIME

But little phosphate was used this year, represented by 90 tons used by the Chemical and Fertilizer Company of Buckingham and 85 tons by the Electric Reduction Company of the same place, making a total of 175 tons, worth $1,610.00.

It is further reported that about 500 tons of phosphate were got out in the upper portion of the Lièvre river, but they will be delivered for consumption next year only.

GRAPHITE

Practically no graphite was got out this year, but some interesting work was done in connection with mills by three companies working in the neighborhood of Buckingham and one near Calumet station on the Canadian Pacific Railway. About 20 men were employed in these various works and only small quantities were shipped as samples.

MAGNESITE

Under this name we shall designate carbonate of magnesia, called also giobertite. Carbonate of magnesia is found mixed with other carbonates, of lime and of iron, giving rise to the rocks known as dolomite, but it is much rarer in the pure or almost pure state. We have no knowledge of its having been mentioned in any other part of Canada.

About 1900 a considerable deposit was pointed out as being on the north ½ of lot 18, range XI, Grenville township (Argenteuil county) but little importance was attached to it. The report of the Geological Survey for 1900 (Vol. XIII, part R, page 14) contains Mr. R. L. Broadbent's notes accompanied by several analyses by Mr. G. F. Wait, indicating the value of the deposit.

These analyses are as follows:

	Carbonate of Magnesia.	Carbonate of lime.	Magnesia other than carbonate.
Magnesite..	77.62	18.07	3.50
"	74.68	18.89	3.71
"	78.08	15.57	4.18
"	77.16	10.78	6.14
"	76.09	16.00	4.29
"	76.97	13.14	5.87
Dolomite..	49.71	30.14	9.17
Magnesite..	75.69	19.71	3.08
"	82.72	12.36	2.53
Average sample..	77.07	16.28	322
Choice sample..	85.00	10.80	
"	95.50	very little	

Mr. W. B. McAllister also found a mass of magnesite on the north ½ of lot 15, range IX of the same township, about 2½ miles from the first deposit. He found an outcropping running about a quarter of a mile with a width of 100 feet. He took many samples, the average analysis of which gave the following results:

Carbonate of Magnesia	Carbonate of Lime	Magnesia other than carbonate
81.27	13.64	3.66

Mr. McAllister mentions free rocks, some of very large dimensions, in certain adjoining lots and he took samples an analysis of which we give below, made by Mr. Johnson, also of the Geological Survey.

		Carbonate of Magnesia	Carbonate of Lime	Magnesia in another form than carbonate
Lot IX	½ S. 15	78.33	15.50	4.13
IX	½ S. 14	99.92	4.39	4.85
VIII	½ N. 12	66.28	23.96	4.85
VIII	½ N. 10 (very large boulders)	71.15	24.11	2.32
VIII	½ N. 13	Samples of magnesite mixed with a little yellow serpentine containing very little carbonate of lime.		
VIII	½ S, 11			
IX	½ S. 13			

In 1907, lot XI½ N. 18 of Grenville was bought from the Government as a mining lot by Mr. Th. J. Waters who also had done some prospecting there. About 200 tons were got out,a portion of which was shipped from Calumet station with the view of making some tests. A certain quantity was then calcined by the Canadian Carbonate Company, of Montreal.

The crude magnesite of that mine was analyzed at the Bureau of Mines, in Ottawa, by Mr. F. Connor, with the following result :

Carbonate of Magnesia	84.50
" lime...	15.00
Oxyde of Iron and Alumina	0.27
Insoluble	2.62
	100.62

The calcined product, analyzed by Mr. J.-F. Donald of Montreal, gave :

Magnesia	74.84
Lime	10.84
Oxyde of Iron and Alumina	1.20
Insoluble	2.62
Lost through calcination	10.40
	100.00

All the foregoing analyses show clearly that there is a real deposit of Magnesite, at that spot.

I visited the mine in October 1908. It is about 14 miles from Calumet station (C.P.R.) with a fairly good road ; it lies only some hundred yards from the road. The magnesite crops out over a length of from 400 to 500 feet, showing at the place where mining was done a width of about 60 feet in the shape of a small hillock about 15 feet high ; the mass is well exposed there and the magnesite appears in a snow-white crystalline form.

This mass forms part of a strip of Laurentian serpentine which may be seen a quarter of a mile to the north on the adjacent lot, where it is mixed with dolomite.

I did not visit the other lots mentioned by Mr. McAllister, on which I have no knowledge of any work having been done, but the quantity on lot 18 is very considerable and justifies the mining work done. It should be observed that the present cost of transportation from the mine to the station is very high, but it might be reduced if the mine were worked regularly.

I took a sample which seemed to me similar to all those that might be got from that mine and the analysis made by Mr. M. L. Hersey, gave:

Silicon	0.25
Lime	6.40
Magnesia	43.28
Carbonic acid and moisture	50.41
	100.34

Corresponding to :

Silicon	0.25
Carbonate of lime	11.43
" of magnesia	86.60
Magnesia in other forms	2.05
	100.34

I also had a small block cut by a marble-cutter who said the rock was a fine white marble, fairly hard, easily worked, which could be successfully used for ornamental purposes. This magnesite could thus be used as a source of carbonic acid and of magnesia and the finest blocks for ornamental purposes.

I give below some information regarding this product which is new in Canada. Magnesite is used as a source of carbonic acid which is itself used in making aerated waters and, in the liquid state, as a refrigerant. The magnesia obtained from the calcination of magnesite is used as a refractory product in the manufacture of bricks and crucibles, for lining the inside of reverberatory furnaces, converters, revolving kilns for cement, electric furnaces, etc., in the manufacture of chemical pulp; it is mixed with asbestos in making asbestos boards and is used in chemical industry, etc.

Finally, it is used on a large scale for making floors by mixing it with an inert matter, such as sawdust, or asbestos and chloride of magnesium. This industry has been known in Europe for a long while, but it is about to assume a great development in Canada and, in Montreal, two companies: the Montreal Doloment Company, Ltd. and the Terrano Flooring Company, of Canada, Ltd., make such floors.

The material is first spread to a depth of half an inch in a plastic state, like cement, either alone or on expanded metal latns to cover old wooden floors and it hardens in a day. The chemical re-action seems to be effected by the formation of an oxychloryde solidifying through the action of the chloride of magnesium on the magnesia. The addition of wood flour, or fine asbestos fibre or other substance, gives consistency to the mass.

As we stated, magnesite has not been found anywhere else in Canada and the countries supplying the market are chiefly Greece (province of Euboea) and Austria (province of Styria). Those two countries produce about 60,000 tons each. It is also found, but is mined on a small scale, in the Transvaal, Italy, Venezuela, Russia (in the Ural mountains) and in the United States, in California, where 4,000 tons were produced in 1906. Statistics show that the United States imported 99,000 tons of magnesite in 1907, but the actual quantity must be greater, for no mention is made of calcined magnesite. Magnesite is used in the United States chiefly as a source of carbonic acid and for the manufacture of bricks and refractory products, the principal producers being the Harbison Walke. Refractory Company of Pittsburg, Penn., and the American Refractory Company, of Chicago.

In Montreal, the Canadian Carbonate Company makes liquid carbonic acid out of European magnesite.

From the New-York quotations, we see that crude magnesite is worth about $8.00 per ton while calcined magnesite is worth from $30.00 to $35.00. There is no duty on the entry of this product into the United States.

It will thus be seen that conditions are favorable to the development of this industry in Canada and we understand that a company has been organized to work the Grenville deposit, that work has been done this winter and fairly large quantities have already been shipped. We may therefore expect a considerable production for 1909.

The new company is the *Canadian Magnesite Company*, of Montreal, and, from information supplied us, it would appear that the surface works show a much greater width of the mass than that mentioned above. The following analysis of the product shipped has been communicated to us:

Carbonic acid	49.85 per cent
Magnesia.....	44.20 "
Lime.....	5.15 "

Last year a couple of hundred tons were conveyed to Calumet station (C.P.R.) a portion of which was shipped to Montreal. In 1908, about 65 tons were also shipped.

MISCELLANEOUS

The Canada Gas and Oil Company, of Three Rivers, has suspended operations. Some boring was done by the *Quebec Fuel Company* in the vicinity of Yamaska where a well was sunk to a depth of over 2,000 feet.

Experiments in [illegible]sing peat were continued in the vicinity of Farnham.

No work of any importance was done in connection with molybdenite, feldspar, sulphate of baryta, or the deposits of manganese in the Magdalen Islands.

During the summer, I visited and examined the veins of galena in Gaspé Bay which accompany the limestone formations of Grande Grève on the north side of the bay. Some work had been done which seemed to show the true nature of these deposits.

Some prospecting was also done in the Eastern Townships on deposits of iron pyrites especially on lot XIII 3 of Bolton, about 300 to 350 yards from the line of the Canadian Pacific Railway and a mile from Moletta station. The vein is 7 feet thick, but contains no copper.. It is in a bed of quartzite.

In Weedon a deposit of iron pyrite without copper was found, which seemed rather abundant, on lot II, 22, about 3 miles from the line of the Quebec Central Railway. In the same vicinity, iron pyrite with a little copper was found on lots III, 17, 18.

Some American newspapers announced that diamonds had been found in the Bell river region, but, after investigation, we came to the conclusion that the rumor was unfounded.

Some excitement was caused in the vicinity of Levis by an alleged discovery of coal. The coal-like substance found there is the same as that found in various other parts of the province, which was studied by the Geological Survey. This product is found only in small quantities and accidentally ; it has no industrial value.

PROSPECTING IN THE NORTHERN REGIONS

Prospecting was continued, but no discovery of any importance has been made known. So long as there will be no railway to reach those distant regions, the minerals found there are not rich enough to attract prospectors. No prospecting was done at Chibougamau this year but merely an exploration, the result of which will be seen further on.

Some prospecting was done in northern Pontiac. The Pontiac and Abitibi Gold Mines Company made a road connecting that mine with Larder

Lake and it intends to put up machinery and mills there and to commence work.

Another company, the *Union Abitibi Company* bought a block of 400 acres in the projected township of Duprat where it claims to have found nickel mines.

In Fabre township, indications of cobalt were found last year and prospecting was continued, especially on lot V north 3.

In the month of June I visited that lot which was purchased as a mining concession from the Crown by A. H. Cooke and C. W. Walcot of Quebec.

Some men were engaged in sinking a shaft which had then attained a depth of 40 feet. The work had been begun on a small vein of hematite in a blueish rock similar to the Keewatin schist. The vein changed into a vein of pink calcite containing smaltite which, at the bottom, is intersected by another vein of white calcite, also containing smaltite. Those two veins were then badly defined, being mixed with rock and presented variable thicknesses of a few inches. They were fairly mineralized and contained a good proportion of smaltite and niccolite.

Samples from this mine were analyzed by Mr. M. L. Hersey, with the following results:

Ore taken by me at the bottom of the shaft:

	Ounces		
Gold	0.2	value	$ 4.00
Silver...	119.2	"	63.17

Rock taken by me at the bottom of the shaft:

Gold—traces.
Silver—traces.

Samples of smaltite taken by me out of a sack of ore from the mine:

	Ounces		
Gold	0.5	value	$ 10.00
Silver...	188.9	"	100.11

Samples of pink calcite and smaltite, forming a vein of 1¼ inch, given by the foreman as coming from the mine:

	Ounces		
Gold	0.42	value	$ 8.40
Silver...	115.28	"	61.10

Sample sent to the Bureau as coming from the mine :

	Ounces		
Gold	0.6	value	$ 12.00
Silver...	189.5	"	94.98

I would call attention to the fact which is not of frequent occurrence in the Cobalt region, that this one contains a strong proportion of gold. From the last information obtained, work was interrupted when winter came and the shaft was then 66 feet deep; the vein had been followed for 32 feet and another adit had been run through banks of a dozen feet. The vein had continued with varying thicknesses, the assays showing good proportions of gold and silver. The owners intend to continue work in the spring.

Work was also done on adjoining lots by the St. Maurice Valley Mining Company as follows :in range V, South of Fabre, on lot 3, a shaft of 15 feet and one of 39 feet; on lot 4 one of ten feet and on lot 5 one of 22 feet.

On lot II 37, a shaft of 70 feet was sunk on indications of smaltite and niccolite already mentioned last year. Some fifteen men were employed during the summer by the company which intends to continue its work.

Some other prospects were made in the surveyed townships of Lake Temiscamingue, especially in Fabre township, but without much success.

PORTLAND CEMENT

As stated in our last report, this industry has assumed a great development and we now have three companies which manufactured and shipped this year 810,695 barrels of cement, worth $1,127,335.00, but in 1909 they will produce about two million barrels. In fact the International Portland Cement Company of Hull, has made new additions to its mill so as to increase its daily capacity to 3,000 barrels, while the Lakefield Portland Cement Company and the Vulcan Portland Cement Company, at Longue Pointe, on the Island of Montreal, only worked part of the year.

As we have already stated, the principle of the manufacture is the same for the three companies. Trenton limestone and clay, both of which are found on the spot, are used. Those materials are dried, pulverized and mixed in proper proportions, put in revolving cylindrical kilns, heated by pulverized coal injected in at the lower end of the kilns; the clinkers of the cement so obtained are crushed, passed through the mill and put in sacks or barrels for shipment.

The Portland cement thus obtained is of very good quality and compares favorably with imported cement. It has been successfully used in connection with a great many public and private works.

Another company, the *Drummondville Electric Cement Company*, has been organized at Drummondville, but it is not yet in operation.

BUILDING MATERIALS

It is difficult and complicated task to give, every year, statistics and details of this industry in which a great many small producers are engaged, who work irregularly and we have made it a rule to take the decennial statistics of Ottawa and to mention only the principal companies in our list. This year a special report has been published by the Department of Mines, at Ottawa, which contains interesting details regarding producers of bricks, lime, building stone, etc., under the head of "Report of the Mining and Metallurgical Industries of Canada, 1907-1908."

The production of granite seems, however, to be less than in previous years, and this is due to the fact that the quarries of Rivière à Pierre, which supplied great quantities of stone for the Quebec Bridge and its approaches, are now partly shut down. The Dudswell Stone and [illegible] Rockland slate quarries have been in operation as usual.

STATISTICS

Summary statement of the production of the mines of the Province of Quebec, for the year 1908.

NATURE OF MINERALS (Tons of 2000 lbs.)	Wages paid	Number of workmen	Quantities shipped or used	Gross value
	$			$
Bog iron ore..	41,054	170	11,628	39,957
Calcined ochre..	12,596	61	1,346	15,440
Raw ochre..	.....	.....	1,500	4,500
Chrome iron..	32,000	70	7,564	83,740
Copper ore..	50,030	122	26,598	159,588
Asbestos..	1,006,774	2,484	65,156	2,551,596
Trimmed mica..	47,724	184	106	95,311
Phosphate of lime..	.....	.....	175	1,610
Prepared graphite (pounds).. ..	6,920	22	2,640	165
Magnesite..	.....	.....	65	520
Slates (squares)..	15,000	50	4,335	20,056
Flag-stone (square yards)..	2,400	12	4,000	3,600
Cement (barrels)..	151,716	395	801,695	1,127,335
Granite (cubic yards)..	238,761	653	30,000	250,000
Lime (bushels)..	33,500	124	556,000	96,000
Tiles and pottery..	.....	.....	.....	270,000
Lime stones (cubic yards)..	155,882	515	97,710	223,580
Totals..	$2,094,357	6,324	.....	$5,493,664

This table shows that the value of the mining products for 1908 was $5,493,664.00, representing the value of the raw material or after having undergone the necessary preparation to make it merchantable.

This industry gave employment to 6,324 men ,receiving $2,094,357 in wages and working for periods of from 4 to 12 months.

According to the reports received, 7 men were killed and 5 seriously wounded in mining accidents.

LIST of Joint Stock Companies incorporated in the Province of Quebec during the year 1908.

Names	*Date of Incorporation.*	*Capital.*	*Place of Business.*
La Compagnie Minière de St. Alexis	11 March 1908	$ 20,000	St. Alexis de Métapédia.
Robertson Asbestos Mining Co	18 January 1908	950,000	Drummondville.
La Compagnie Minière de Jonquière	12 February 1908	200,000	Chicoutimi.
La Compagnie Minière du Sault Caron	23 March 1908	200,000	Chicoutimi.
The Stanhope Granite Company	30 April 1908	150,000	Montreal.
The Abitibi Union Mining Co	15 May 1908	2,000,000	Montreal.
The Marsboro Goldfields Co	27 July 1908	1,000,000	Sherbrooke.
Quebec Mineral Exploration Co	4 August 1908	20,000	Montreal.
The Prospect Hill Gold Mining Co	3 September 1908	20,000	La Patrie.
The Champlain Asbestos Company	23 September 1908	300,000	Quebec.
The Twin Beaver Mining Co (no personal liability)	27 November 1908	1,000,000	Montreal.
Imperial Asbestos Co., Ltd	13 December 1908	1,000,000	Montreal.
The Compton Gold Dredging Co	19 December 1908	500,000	Montreal.

Foreign Companies authorized to work in the Province, (4 Ed. VII, ch. 34.)

Names	*Date of Incorporation.*	*Capital.*	*Place of Business.*
Albert Copper Co	18 March 1908	$ 10,000	Lenoxville.
The Union Sulphur Co	25 November 1909	400,000	Montreal.

List of mining companies in the Province of Quebec in operation or in a position to work, with their addresses.

MAGNETIC SAND

Quebec Iron Ore Co., 75 St. Peter Street, Québec.
H. C. Bossé, 112 St. Peter Street, Quebec.
W. Robertson, 233 St. James Street, Mnotreal.

CHARCOAL PIC IRON

The Canada Iron Corporation Ltd, Imperial Bank Building, Montreal.

TITANIC IRON

G. Gagnon, 87 Artillery Street, Quebec.

OCHRE

Canada Paint Co., Ltd., 572 William Street, Montreal.
Champlain Oxyde Co., Lucien Carignan, Three Rivers.
Thomas Argall, Three Rivers.

CHROME IRON

Black Lake Chrome & Asbestos Company, Black Lake.
American Chrome Co., Black Lake.
D'Israéli Chrome Mines, Ltd., Sherbrooke.
Canadian Chrome Co., St. Hyacinthe.

COPPER

Eustis Mining Co., Eustis.
Nichols Chemical Co., Ltd., Capelton.
Albert Copper Co., Capelton.
J. McCaw, Sherbrooke.
A. O. Norton, Coaticook.
G. E. Smith, Sherbrooke.
A. F. Foss, Lennoxville.

GOLD

Pontiac and Abitibi Gold Mines Co., Montreal.
C. A. Parsons, South Dudswell.
Louis Mathieu & Cie, Beauceville.
Louis Gendron, Jersey Mills.
C.-E. Kennedy, Beebe Plain.
Marsboro Gold Mining Syndicate, Sherbrooke.
The Compton Gold Dredging Co., Montreal.

GRAPHITE

The Bell Mines, Buckingham.
Diamond Graphite Co., Buckingham.
Buckingham Graphite Co., Buckingham.
Calumet Mining and Milling Graphite Co., Calumet.

MANGANESE

Magdalen Islands Development Co., Montreal.

ASBESTOS

Bell Asbestos Co., Ltd., Thetford Mines.
King Asbestos Mines, Ltd., Thetford Mines.
Johnson Asbestos Co., Thetford Mines.
Beaver Asbestos Co., Thetford Mines.
Thetford Asbestos Exploration Co., Thetford.
The British Canadian Asbestos Co., Ltd., Black Lake.
Standard Asbestos Co., Ltd., Blakc Lake.
Dominion Asbestos Co., Ltd., Black Lake.
Imperial Asbestos Co., Ltd., Montreal.
Union Asbestos Mine, Black Lake.
James Reed, Reedsdale.
Broughton Asbestos Fibre Co., Ltd., East Broughton.
Quebec Asbestos Co., East Broughton.
Eastern Townships Asbestos Co., East Broughton.
Frontenac Asbestos Mining Co., East Broughton.
Boston Asbestos Mining Co., East Broughton.
Champlain Asbestos Co., Quebec.
Robertson Asbestos Mining Co., Thetford Mines.
Brome County Development Co., Ltd., Montreal.
The D'Israeli Asbestos Co., D'Israeli.
Asbestos Mining and Manufacturing Co., Chrysotile.
Asbestos and Asbestic Co., Danville.
R.-H. Martin, New-York.

Colraine Asbestos and Exploration Co., Ltd., Colraine Station.
Premier Mining Co., Colraine Station.
Beauceville Asbestos Co., Beauceville.
Ottawa Asbestos Mining Co., Ottawa.

MICA

Blackburn Bros., 46 Sussex Street, Ottawa.
Wallingford Mica and Mining Co., 41 Duke Street, Ottawa.
Wallingford Brothers, Ltd., 24 Central Chambers, Ottawa.
Fortin & Gravelle, Hull.
General Electric Co., Isabelle Street, Ottawa.
Laurentides Mica Co., corner Queen and Bridge Streets, Ottawa.
Vavassour Mining Association (E. F. Nellis), 22 Metcalf Street, Ottawa.
Comet Mica Works, 398 Wellington Street, Ottawa.
Lila Mining Co., D.-L. McLean, 6 Sparks Street, Ottawa.
Allan Gold Reefs Co., Ltd., Victoria Chambers Ottawa.
Webster & Co., 274 Stewart Street, Ottawa.
Thomas J. Waters, Metropolitan Building, Ottawa.
Brown Brothers, Cantley.
Lewis MacLaurin, East Templeton.
Richard Moore, Picanock.
Glen Almond Mica and Mining Co., Buckingham.
Kent Bros., Kingston, Ont.
Henry F. Flynn, Maniwaki.
Chabot & Cie, Ottawa.
Gatineau Valley Mica Co., H. H. Moore, Cantley.
C. W. Berry, 424 McLeod St., Ottawa.
Calumet Mica Co., Bryson.
Cawood Mica Co., 38 Spark St., Ottawa.
W. Argall, Laurel, Argenteuil Co.

WHITE MICA

Canadian General Mining Co., Ltd., P.O.B. 253, Montreal.

PURCHASERS OF MICA

Laurentides Mica Co., Ltd., Bridge and Queen Str., Ottawa.
Eugène Munsell & Co., 332 Wellington Street, Ottawa.
General Electric Co., Ottawa.
Webster & Co., 274 Stewart Street, Ottawa.
F. D. Moore, 374 Wellington Street, Ottawa.
Ottawa Mica Co., Hull.
A. Roy Macdonald, jr., 68b St. Urbain, Montreal

PHOSPHATE

J.-F. Higginson, Buckingham.

FELDSPAR

W.-A. Allan, Victoria Chambers, Ottawa, Ont.

MAGNESITE

Canadian Magnesite Co., Montreal.

KAOLIN

F. R. Lanigan, 23 Côté Street, Montreal.

TALC

C. V. M. Temple, 175 Spadina Road, Toronto, Ont.

SULPHATE OF BARYTA

Canada Paint Co., 572 William Street, Montreal.

COMBUSTIBLE NATURAL GAS

Canada Gas & Oil Co., Three Rivers.
Quebec Fuel Co., Montreal.

PEAT

Imperial Light, Heat & Power Co., Ltd., Liverpool, London & Globe Building, Montreal.

SLATE

Rockland Slate Quarry, New Rockland.

FLAG-STONES

F. R. Bishop, Bishop's Crossing Co., Wolfe.

CEMENT

International Portland Cement Co., Ltd., Hull.
The Lakefield Portland Cement Co., Ltd., Pointe aux Trembles.
Vulcan Portland Cement Co., Ltd., Longue Pointe.
Electric Cement Company of Drumondville.

GRANITE

Stanstead Granite Quarries Co., Ltd., Beebe Plain, Co. Stanstead.
S. B. Norton, Beebe Plain.
James Brodie, Graniteville, Co. Stanstead.
The Whitton Granite Quarry Co., St. Victor de Tring.
M. Fitzgerald, Ste. Cécile, Co. Compton.
Fortunat Voyer, Rivière à Pierre, Co. Portneuf.
Joseph Perron, Rivière à Pierre.
M. P. Davis, 48 Central Chambers, Ottawa.
The Laurentian Granite Co., Ltd., Montreal.
J. A. Nadeau, Iberville.
Montfort Granite Co., Ltd., Montreal.

BRICKS.—(Companies producing over 1,200,000 bricks per annum)

Thos. W. Peel & Co., Montreal.
J. Brunet & Cie, Montreal.
Chs. Sheppard & Son, Montreal.
Joseph Bernier, Montreal.
Joseph Descarrie, Montreal.
The Montreal Silicate Brick Co., Montreal.
C. Bourdon, Montreal.
J. Keegan, Montreal.
The Crown Pressed Brick Co., Ormstown.
Alex. Mills, Ormstown.
Courchene & Cie, Drummondville.
Emile Theroux, Mitchell Sta.
St. John's Brick Co., St. John's.
Louis Fontaine & Cie, Shawenegan Falls.
Belisle & Lachapelle, Yamaska East.
Laprairie Brick Co., Ltd., Laprairie.
Narcisse Blais, Quebec.
Paradis & Létourneau, Quebec.
Laliberté & Fils, St. Jean Deschaillons, Co. Lotbinière.
Victor Charland, St. Jean Deschaillons.
Edouard Laliberté, St. Jean Deschaillon.

There are at the same place some fifteen persons, each manufacturing a million bricks.

D. G. Loomis & Son, Sherbrooke.
The Eastern Townships Brick and Manufacturing Co., Lennoxville.
Brière & Rouleau, St. Tite, Co. Champlain.
Onésime Lafontaine ,St. Tite, Co. Champlain.

Lime (The principal companies)

Dominion Lime Co., Sherbrooke.
Cyrille Gervais, Montreal.
Olivier Limoges, Montreal.
Montreal Lime Co., Montreal.
Sovereign Lime Co., Montreal.

BUILDING STONE

The Louis Labelle Quarry Co., Ltd., St. François de Salles.
Cie des Carrières de St. François de Salles, St. François de Salles.
Joliette Limestone & Quarry Co., Joliette.
Standard Lime & Quarry Co., Joliette.
Frelighsburg R. & Quarry Co., Philipsburg, (Missisquoi).
Keegan & Dillon, Montreal.
Peter Lyall & Son, Montreal.
The Model Building Stone Co., Montreal.
Morrison Quarry Co., Montreal.
Roger & Quick, Montreal.
Harrison Quarry Co., Montreal.
Dominion Quarry Co., Montreal.
O. Limoges, Montreal.
Grondine Stone, Lime and Brick Co., Three Rivers.
Bedard & Perreault, Châteauvert.
Damase Naud, Châteauvert.
La Cie des Carrières de St-Marc, St-Marc des Carrières.
François Parent, Beauport.

Companies utilizing certain products of the mines to be manufactured in this Province

The Electric Reduction Co., Ltd, Buckingham (ferrochrome and phosphorus).
The Chemical and Fertilizer Co., Buckingham (Superphosphate).
Electro Manganese Reduction Co., Shawenegan.
Shawenegan Carbide Co., Ltd., Shawenegan.
Standard Chemical Co., Coaticook (Acetate of lime).
The Standard Drain Pipe Co., Ltd., St. Jean d'Iberville.
C. E. Dubord, Beauport, (Refractory clay).
Geo. Bélanger, Beauport, (Refractory clay).
The Montreal Terra Cotta Co., Ltd., Maisonneuve.

Report on an exploration journey to Shining Mountain

IN THE LABRADOR PENINS' 'LA

BY J. H. VALIQUETTE B.A.Sc., C.E.

Shining Mountain is in the county of Saguenay, P. Q., about latitude 51 degrees, 50 minutes north and longitude 70 degrees, 25 minutes west. All the land there, with the mountain, belongs to the Crown and so does that on either side of the route selected.

Many routes may be followed to reach that mountain. ' followed that which passes successively by the Manikuagan, Outardes and Owl rivers, lake Pletipi and the west inlet of that lake, that route being known as that of the Outardes river by the Indians who follow it to get to the Hudson Bay Company's post on lake Nichicun. This route was chosen in preference to that by the Manikuagan river because we had no mineralogical or geological data regarding the surrounding land.

The Manikuagan river was followed as far as about the thirty-seventh mile above the confluence of the Tootnustook where I took an Indian portage to get to the Outardes river. The distance at this point between the two rivers, measured in a straight line from East to West is about 17 miles, but it is at least thirty miles by the portage road in following which we had to go around mountains, cross lakes and follow a small river.

We came to the Rivière aux Outardes at a point about four and a half miles above the falls called "Descente des Femmes."

That river was followed to about half a mile above its tributary, the Blue Berry River, this point being 213 miles from the sea. Thence I took a portage road leading to the little Owl river to avoid an almost continual and heavy rapid, as far as the confluence of the Owl river where we arrived, descending it. Thence I again followed the Rivière aux Outardes to lake Pletipi, which I crossed to ascend its inlet as far as Shining Mountain.

After completing my searches on that side, I went to the eastern inlet of the lake, a distance of about 40 miles and came back. The same road was followed on the return, but I spent a week on the Long river, a tributary of the Outardes and two days on the Tootnustook.

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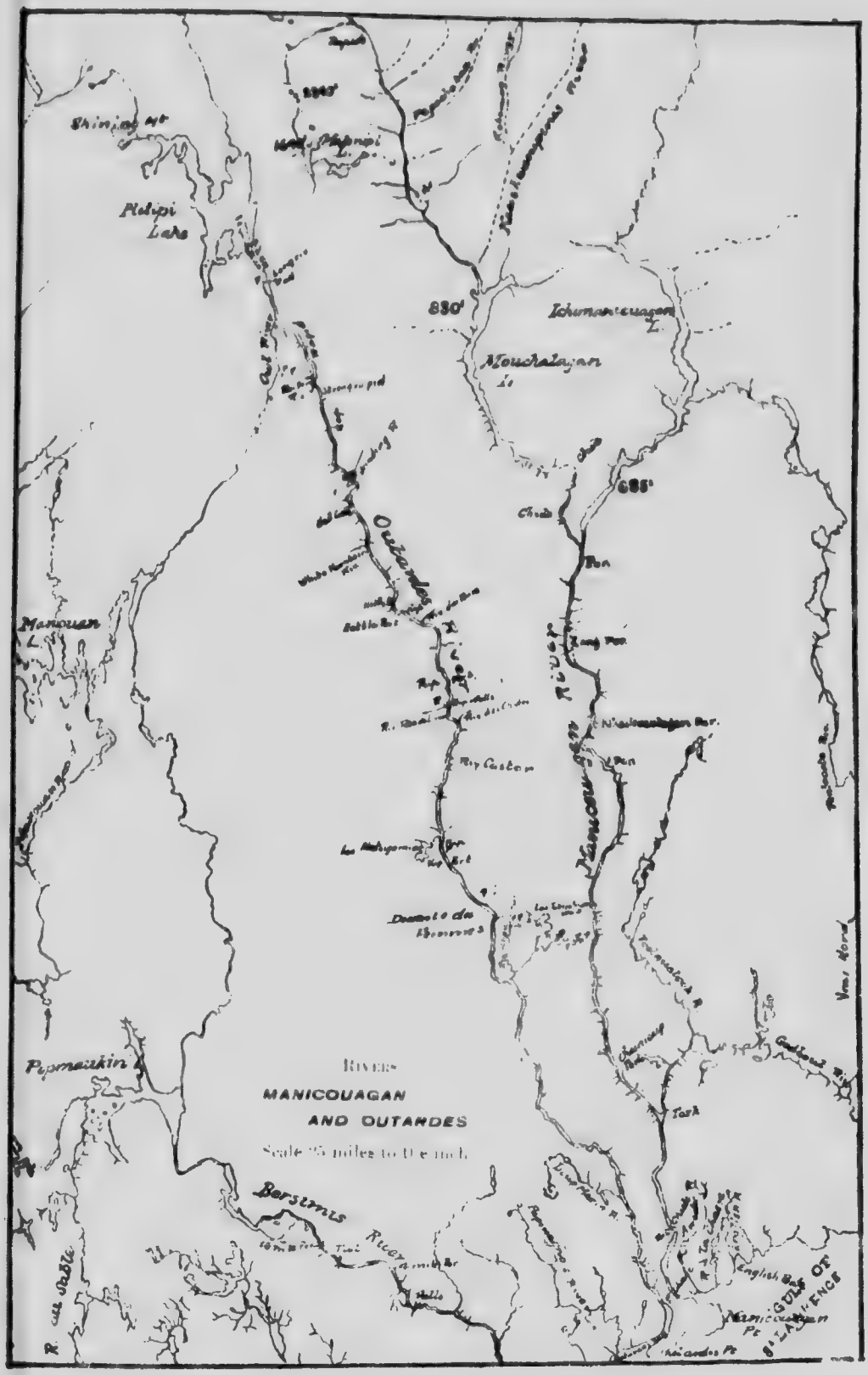

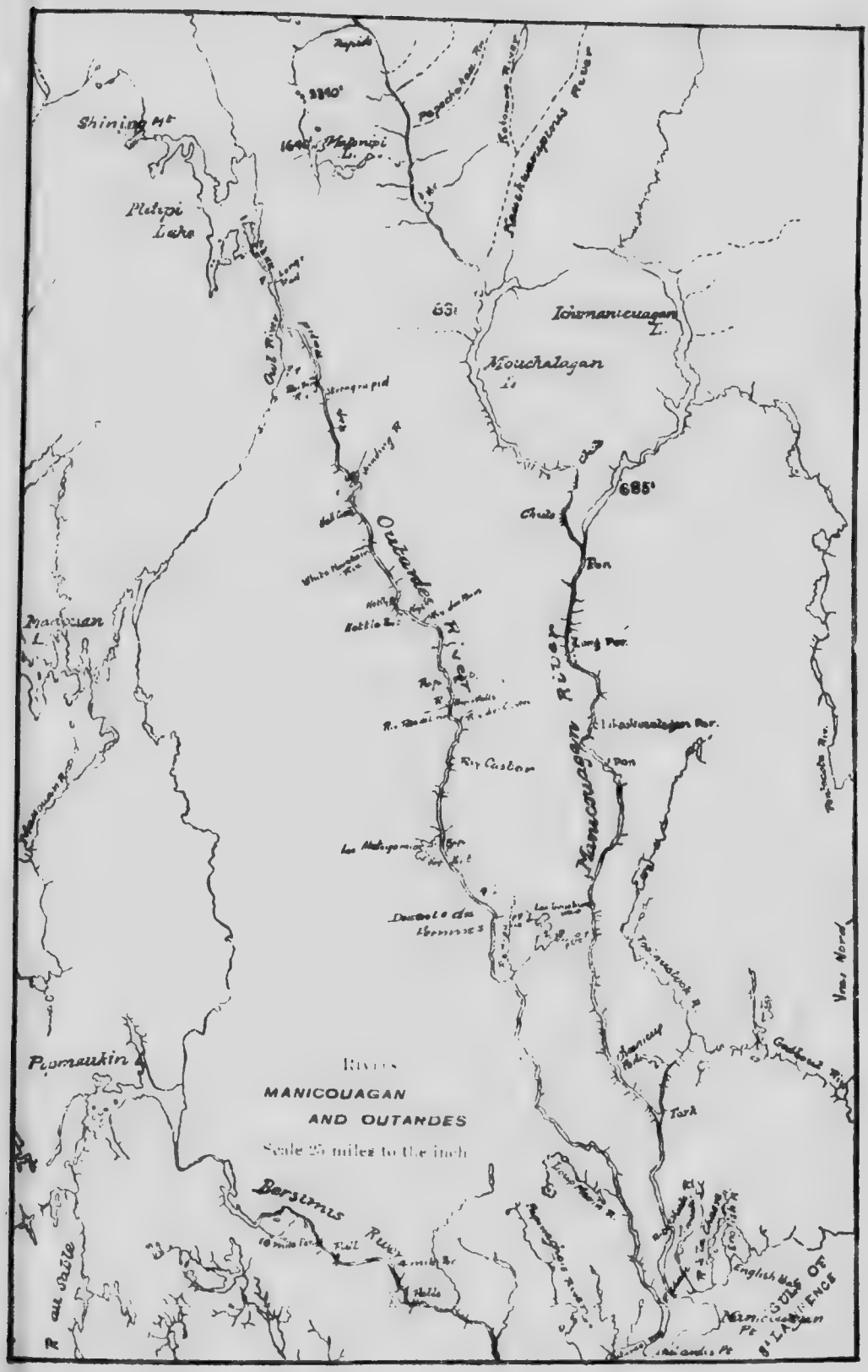
Shining Mt
Pletipi Lake
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Mouchalagan L.
Outardes River
Manicouagan River
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Pon
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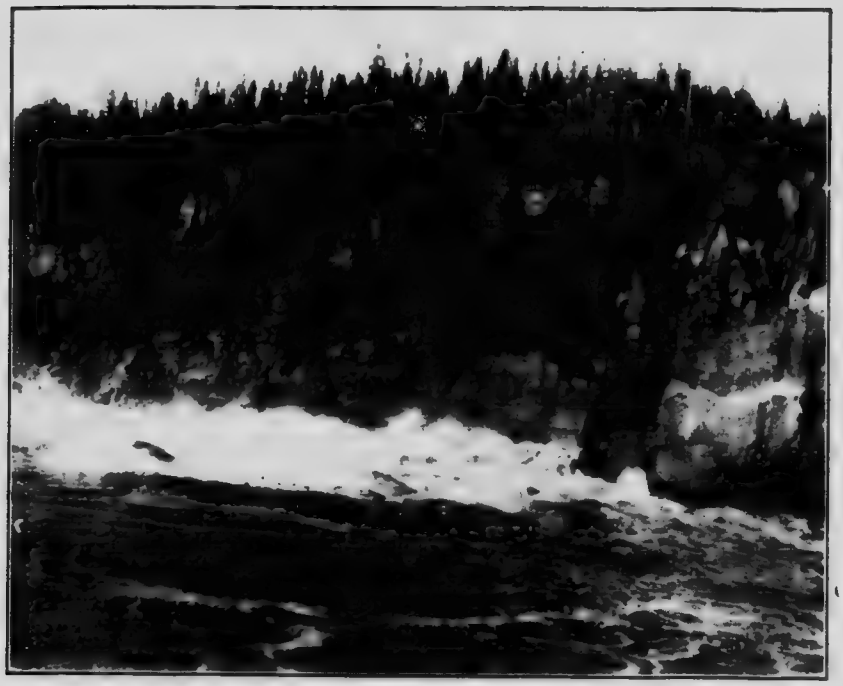
Pipmaukin
Bersimis River
Tark
English Bay
Manicouagan Pt
GULF OF ST LAWRENCE
Vrai Nord
Rivers
MANICOUAGAN
AND OUTARDES
Scale 25 miles to the inch

Manikuagan river below the first falls

Manikuagan river above the first falls



Cascades and Gneiss cliffs – 2nd falls Manikuagan river

On the Manikuagan river; starting from lower portage for Rivière aux Outardes.

DESCRIPTION OF THE ROUTES FOLLOWED.

Manikuagan River.—The Manikuagan river, the volume of whose waters is very considerable, falls into the Gulf of St. Lawrence about 240 miles below Quebec. For the first four miles, the direction is due west and the channel is not less than three miles wide with many islands and sand banks, visible at low tide and making navigation impossible for vessels of heavy tonnage. In the two following miles, the current increases in strength, the river narrows and the channel contains several small rocky islands, followed for two miles in a northwesterly direction by a series of rapids and falls, the highest of which is about 30 feet, making a difference of level of 90 feet in all. At the place where the rapids and falls are, the channel is barely a few hundred feet wide and the water falls between two vertical walls of rock .

The portage for getting around these obstacles follows a shanty road on the west side of the river. It is very fine and easy to pass over, with the exception that it is three miles and a half long. There are two high hills at the start and the remainder is almost level. From the head of the portage, the river runs up about two miles towards the north, along the west side of the valley which is about a mile wide and well timbered with spruce, white birch, balsam fir and some black and yellow birch.

About six hundred yards higher up, on the west side, is a trail followed by the Indians on their way to the Rivière aux Outardes, a distance of about four miles and thence to Bersimis where they pass the summer.

From this point towards the Gulf the Rivière aux Outardes diverges from the Manikuagan and, as it reaches the sea, it flows due west, so that the two rivers at their mouths are about fifteen miles distant from one another, having between them a vast peninsula of clay and stratified sand which must have been carried there by their waters. This peninsula is covered with trees growing pretty closely together, but of small size as a rule.

Above the first portage, the Manikuagan river flows from the north and then from the north-north-east for the next ten miles . The channel which tends rather to follow the west side of the valley, is about a quarter of a mile wide at the foot, but it narrows higher up,the strength of the current increases and there are many islands, covered with trees, in the river. The adjacent mountains are low and covered with small trees. The one called "Montagne Salée" is about a mile above the first portage. It is about 600 feet high and juts forward to the channel of the river: it takes its name from a salt spring flowing from its side on the bank of the river. The soil of the valley consists of clay and sand and is well wooded : the diameter and height of the trees are frequently sufficient to supply good building timber.

In the next two miles, navigation is interrupted by a series of falls and

rapids through steep rocks, which necessitates a second portage. This portage, about two and a half miles long, is on the west side of the river over a very good road. At first, we have to ascend a long hill which takes us to a plateau about three hundred feet above the river at the lower part ; the remainder of the road is almost level with the exception of a hill 140 feet high, at the upper part. The soil along this road consists of sand and clay and it is well wooded ; it forms a fine block of land from two to three miles square, intersected by small streams with deep valleys. . At the end of that distance the river makes a bend to the east where it is bordered by mountains from seven to eight hundred feet high, but it turns again to the west in the middle of the valley at the head of the rapids. The total difference of level is about 160 feet and it is caused by a rapid about a mile long followed by a fall, then a lake and another small rapid at the head of which is another fall. The last portage mentioned above is the one that was used during the lumbering operations, but there is another which runs nearer the river and is shorter; this is the Indian portage. It starts immediately from the foot of the rapid and we have to pass over an immense pile of very large pieces of granite at a sharpe angle. Then we take to the woods for a mile and re-embark; then 250 yards further we portage for about 600 yards and take to the river in smooth water. This point is about three quarters of a mile below that where the other portage comes out. The river then inclines a little to the west and after about 600 yards it flows northward ; it is then bordered by mountains from 800 to 1000 feet high often in steep cliffs along the channel and most of them with bare summits.The course continues in that direction for about ten miles and turns to the northeast for two or three miles and then to the north as far as the fork or confluence of the Tootnustook. In this distance, the valley is often limited to the bed of the river and the current is generally pretty strong, running from three to five miles an hour. Sometimes there are here and there, on either side of the channel, good lots of land fairly low and well wooded, the trees suitable for lumbering being the same as those mentioned above.

The Tootnustook river is one of the most important tributaries of the Manikuagan; it is about 200 feet wide at its mouth where the current is slow and the channel deep. Its direction in the first four miles is north-north-east and the current increases all the time, becoming a rapid in the end. It flows through a valley three quarters of a mile wide consisting of good farming land ; the surface, to the depth of two or three feet, is sand mixed with a good proportion of clay resting on stratified clay, the beds of which are sometimes pretty thick. This valley and the mountains bordering it are very well wooded and lumbering was carried on there some years ago. Above the fork, the main river runs in a northwesterly direction for the next eleven miles, then it turns sharply to the northeast for half a mile to the Chesnicup portage. The current is very strong and in many places the canoes have to be poled up which greatly

Upper portion of Chesnicup rapid—Manikuagan river

Lower portion of Chesnicup rapid – Manikuagan river

delays progress owing to the many halts that have to be made. The river narrows a little and the very high mountains against which the water dashes in the bends are more or less bare with very high steep cliffs. The average width of the valley is one mile and the soil consists of stratified clay and sand in high banks on either side of the channel, sometimes rising over 150 feet. There is a fair quantity of timber, but it is small as a rule; the chief kinds of trees are white birch, aspen, black and white spruce, banksian pine, balsam fir and a few butternut.

The Chesnicup or third portage is on the west side of the river; it is half a mile long and the road is fairly good. At the start there is a hill about two hundred feet high and then the land is almost level until it descends to the river at the upper end of the portage. The soil is sandy and there is but little timber, fire having swept through there some years ago. The river makes a bend to the east and flows along the mountains running through a very rocky gorge with several falls connected by heavy rapids. The total difference of level is about 100 feet over a distance of half a mile; at several spots the channel is barely a hundred feet wide and is bordered by vertical cliffs of anorthosite.

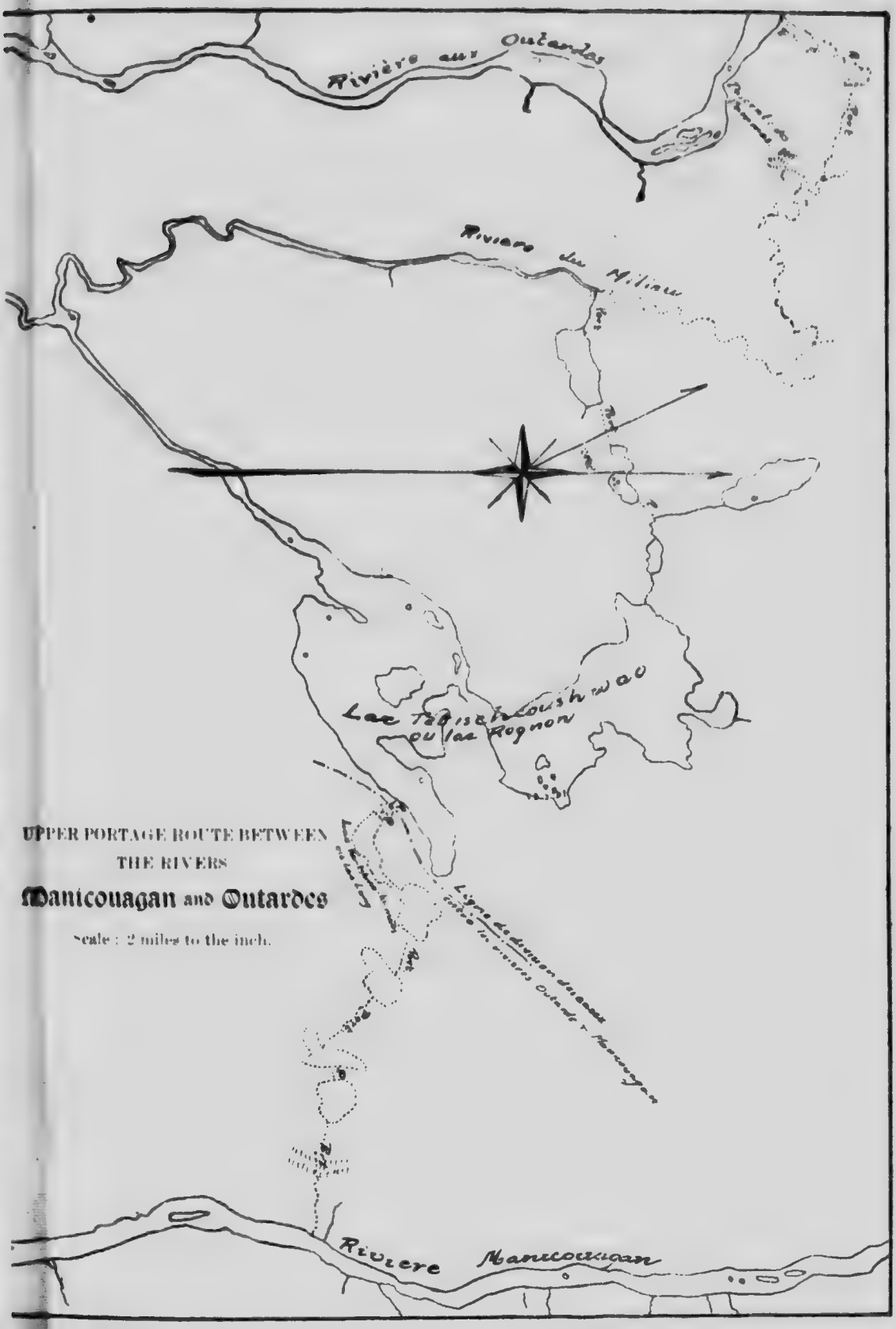
Above that portage the direction of the river is northerly for a mile, then westerly for a mile and a half when we come to the first whirlpool, so called on account of the dangerous eddies that have to be passed. It continues in that direction making several bends to the twenty-seventh mile above the forks in a comparatively narrow valley, with a well wooded soil. The mountains are high, partly bare and very steep, retaining their picturesque aspect as described above.

The channel, from the Chesnicup rapid, is narrow and the current very strong; poling has to be resorted to, but long eddies frequently occur which facilitate the ascent. The direction for the next ten miles is practically north, the channel is much wider, about two thousand feet, and the current is slow, making this stretch easy to ascend. While the river is thus changing, the mountains bordering the valley a mile wide, have lost their picturesque appearance, the slopes are more gradual and more wooded, especially in front of Sand Island, on the east side of the river where the trees grow close together and are suitable for building timber; the principal varieties are white birch, spruce, balsam fir and aspen. Lumber could probably be obtained in paying quantities in this forest which is situated above the place where lumbering was done on the Manikuagan. Above that stretch, at the 37th mile, we come to the portage towards the Rivière aux Outardes.

UPPER PORTAGE BETWEEN THE MANIKUAGAN AND OUTARDES RIVERS

The starting point at that portage, which is rather a series of portages, is on the west side of the Manikuagan river about 80 miles from the sea, following the course of the river. The direction of the first stretch is west north-west. It is about a mile and three quarters long and we come to the first little lake called lake No 1 which is crossed in the same direction. The land for the first three quarters of a mile is very flat and is a vast blueberry field, as a forest fire formerly destroyed all the timber and bared the sand forming the soil. A few small aspen, tamarack and white birch have grown up here and there. Now we ascend a mountain passing by a small valley which brings us to a point 700 feet above the river. The adjacent mountains are from 800 to 1000 feet high and are almost bare. Then the trail slopes down slightly to the lake above mentioned, on the other side of which the direction is westerly for 350 yards to lake number 2 which is crossed and then the trail runs northwesterly to lake No 3. This last portage is about a mile long, the road runs between hills of little height, covered with timber of fair dimentions. The trees noticed are : spruce, fir, white, black and yellow birch, mountain ash and several kinds of ordinary bushes. The third lake is half a mile wide and the road on the west side is similar to the foregoing one. Then we come to lake Katshimo-ki-mats or Long lake which takes us to near the large lake Tetischeoushwao or Rognon lake which is reached by two other short portages towards the north-west in the latter of which we cross the watershed between the Outardes and Manikuagan rivers.

The Indians say that all the lakes east of Rognon lake discharge into the same little river which flows a few miles further north and falls into the Manikuagan river a few hundred yards above the starting point of the portage. This river could, therefore, probably serve as an outlet for the timber which is to be found in fairly considerable quantities in this territory. Lake Rognon which is very irregular in shape is about six miles long at its greatest length and its width varies between a few hundred feet and three or four miles. About the middle are narrows where its width is some five hundred feet and it is bordered on the west side by a rocky cliff and a large sandy spit on the east side, which is low and well wooded. The lower end of the lake, dotted with many islands, is circular in shape with a large bay stretching towards the east ; the upper part is about three miles long with an average width of a mile and a quarter, it also contains several islands. The land around the lake is fairly well wooded and is generally mountainous. The northern part consists of sand hills covered with boulders and was completely swept by fire some years ago. On the other side of Lake Rognon we ascend its north-west inlet to a small lake where we make three portages of about half a mile each, separated by small lakes, to reach the river Ka-pitutaustits or Rivière du Milieu. The distance from Lake Rognon to the Rivière du Milieu is about five



UPPER PORTAGE ROUTE BETWEEN
THE RIVERS
Manicouagan and Outardes

Scale : 2 miles to the inch.

miles. By following the portage road, we pass through a region swept by forest fires and covered with sand hillocks and boulders.

In the last portage we descend a long hill about 400 feet high above the river ; so that, at this spot, the average height between the two rivers, the Rivière du Milieu and the Manikuagan, varies between four hundred feet and seven hundred feet above their beds; all the intermediate lakes are therefore at a good height above the points where they fall into the principal rivers.

The Rivière du Milieu, with a fairly considerable volume of water, flows over a bed of sand and of boulders and its width varies from 50 to 100 feet. Its general direction is magnetic north; for the first six miles it winds through a fine large valley hemmed in between large mountains of gneiss. This valley is about three quarters of a mile wide and frequently less; its soil consists of more or less thick layers of sand on heavy beds of stratified clay, lying almost horizontal.

Higher up, the direction of the river changes; for the next ten miles it is west and north-west.

The distances mentioned are calculated by the hour's rate of travelling in canoes. Consequently they include all the bends and can only be approximate; in any case we have allowed a certain margin for the current, etc. At the same time that the general direction changes, the valley widens and the river runs with many bends through a rather vast bare plain covered here and there with sand hillocks. The soil consists of sandy earth covered with moss and debris of burnt wood; it is probably but little fit for cultivation. All the timber has been destroyed by fire from Lake Rognon to a point about 180 yards before leaving the Rivière du Milieu on the west side. From the latter river the portage runs westward for about a mile and three quarters to a small lake which is crossed to the west-north-west; then the direction is south-south-west and then south passing by two other small lakes to the Rivière aux Outardes, a total distance of three miles from the Rivière du Milieu. The first part of this distance is on a sandy plateau swept by a former forest fire, then the land is swampy and fairly well wooded with spruce, fir, banksian pine, white birch, aspen and tamarack; in some places, aspen and white birch predominate, while elsewhere spruce, fir and banksian pine are the most numerous. No outcropping of rock was observed along that distance with the exception of many gneissic boulders scattered more or less abundantly here and there.

RIVIERE AUX OUTARDES

To reach the Rivière aux Outardes, we have to descend a steep hill from the summit of which the river appears in a vast sheet of water extending about three miles to the north-west with a width of nearly a mile. The view from

here is of admirable beauty especially in the mornings when the sun's rays pierce through the mists rising from the water and mirror the sand of the extensive banks here and there in the bed of the river flowing slowly through a fine wide valley bordered on both sides by chains of parallel, well-wooded mountains. The leaves of the white birch and aspen, in varied tints of red or yellow through the effect of the cold rains, contrast with the dark background of the firs, which produces the illusion of a large carved frame surrounding this unique picture. Further on, the river continues its course towards the north for eleven miles with successive narrowings and widenings to the first portage which is on the east bank.

Along this distance, the current is generally slow and the ascent of the river is very easy except in some stiff bits and sometimes the sand banks are so arranged that one would think the channel completely barred were it not for the current. The valley is wide, but contains little timber; the soil is sandy, rising sometimes in hills a hundred feet high. The first portage is around a rapid 180 yards long, the difference in level being ten feet ; three quarters of a mile further on is the second portage of about the same length. Here the river drops 20 feet in a fall and rapid. At the head of the portage, the direction is north-east for a mile, then north-west for half a mile and thence north-northeast to the Grassy river where it turns a little more to the east to a great landslide on the west side, a distance of about twelve miles from the rapid, this point being 124 miles from the sea. The valley narrows slightly, but is still wide on the whole and similar to that described above, the sand hills in some places rising to 125 feet; it is fairly well wooded as are also the adjacent mountains ; the spruce trees sometimes attain a diameter of ten or twelve inches but the timber is small as a rule. In the next ten miles, the course winds more or less and runs in a general northeasterly direction ; the general aspect is similar; the mountains are not high, except in some places where they may attain 1000 feet. The current is pretty strong as a rule but the ascent of the river is easy. From the Rivière des Chutes, a tributary of the Rivière aux Outardes, 135 miles from the sea, the latter river makes a great bend towards the west and afterwards runs towards the north-east making several other bends to the third portage called "Steep Portage", a distance of about nine miles ; thence the river widens into a lake and runs northerly for a mile and a half when the fourth portage is reached; for the next ten miles and a half the general direction is about north to the mouth of the River of the Woods at the 156th mile. The valley has not changed much, except that it has been mostly swept by fire above the fourth portage, especially on the east side. At the 141st mile, the Hare's Head river falls into the Outardes, forming a very fine fall of about a hundred feet not far from the confluence; the current is at times very strong. Above the River of the Woods, the water is shallow and flows over a bed of boulders, becoming more rapid all the time as far as the Kettle

On the upper portage route leading to Rivière aux Outardes.

Rivière aux Outardes above the falls called Descente des Femmes

Rivière aux Outardes—falls 40 feet high, 140 miles from the sea
(Mass of gneiss)

Indian family on a beach of boulders—Rivière aux Outardes

portage a distance of about three miles towards the north-west. This last portage, about two miles long, is passed by on the west side through land that was burned over twelve years ago. It is very fine and level throughout its whole length with the exception of two hills on leaving and on reaching the river. The soil is completely bare, consists of sand and is probably but little fit for cultivation ; all along the road are small banksian pine trees, an inch and less in diameter, which make this plateau look like a green meadow. In this distance there is a considerable difference in the level of the river, owing to a series of heavy rapids and falls, the one at the head being about 25 feet high. Further up the river inclines a little towards the north and then runs pretty regularly towards the north-west for some fifty miles to the two hundred and thirteenth mile, the starting point of the portage to the little Owl river.

For the first four miles above the Kettle portage, the current is very strong and the valley wide with little timber, then the channel, with many islands, widens and the water flows more slowly while, at the same time, the mountains close in and present a wild and picturesque appearance; they are very high and frequently rise in steep cliffs ; in some places there are good groves of good timber. This continues to the mouth of the river of the White Mountain where the channel again narrows, and some miles higher it is walled in between two rocky cliffs where the water flows in a rapid through a gorge from 120 to 180 yards long. From the Hell creek, the valley widens and assumes the proportions of a plain two or three miles wide, in which the river makes a series of very sharp bends. The soil here seems very good for cultivation; in places about a foot thick of grey loam containing a good proportion of clay was observed, the remainder is ordinary sand. The mountains have lost their picturesque appearance and the summits are more rounded. Above the great bends, the current is slow and the valley wide and well wooded, spruce and banksian pine prevailing. About the 202nd mile a long and very heavy rapid begins which continues as far as the starting point for the Owl river. The current is very strong, flowing over boulders very dangerous for canoes. The mountains have continued to become lower and the valley is covered with sandy hillocks rising in high mounds some of which are composed of gravel.

Portage of the Owl River.—This portage about seven miles long, starts about half a mile above the confluence of the Blueberry River. The direction is north-westerly for a mile and a half to a little lake, then westerly for three miles to another lake on the other side of which, by two other portages to the north-west, the Owl river is reached. The land along the route is level and has been almost completely swept by former forest fires with the exception of a few well wooded swamps. Many boulders are scattered here and there on a sandy soil.

Owl River.—The direction of the Owl river, which is a mere stream at

the place where we took to it, is about astronomical north. It flows through a vast plain full of mounds, with many bends and many rapids which necessitate five small portages, all on the east side . The plain through which this little river runs consists chiefly of low, swampy lands and knolls of very sandy greyish loam. It is fairly well wooded, but the trees are sometimes scattered and are generally small, especially on the sandy knolls. The trees are black spruce, tamarack, and especially banksian pine which grows here and there on elevated spots through white moss (sphagnum), keeping the soil damp; the tamarack here is also green and some trees are ten or twelve inches in diameter. The route by this little river is used to avoid ascents which are difficult to pole up and there are several portages necessitated by the heavy and continual rapids of the Rivière aux Outardes as far as the confluence of the Owl.

Upper part of the Rivière aux Outardes.—The Owl river falls into the Outardes at a point 228 miles from the sea where the channel is wide and contains two small islands of drift.

The Rivière aux Outardes, on leaving the forks, is very wide and there is not much current, but a few hundred yards further up and as far as Burnt Island Lake, it is broken by many rapids, two of which necessitate portages on the west side. Burnt Island lake is merely a widening of the river bed about 3½ mile slong by 1½ mile at its greatest width ; it is dotted with many well wooded islands. Right at the head of the lake a fall is avoided by a portage on the west at the head of which is the Long river, supposed to be the outlet of Matonipi lake. From the forks to this point the river banks are generally flat and there is no mountain of any importance to be seen. The timber is green everywhere and grows close together. Above the confluence of the Long River, the general trend is north-westerly to Lake Pletipi, a distance of about seven miles. Along this distance several rapids are passed, four of which necessitate short portages. About two miles above Long river, the channel widens and becomes a lake, with a great many fine large islands blocking it almost completely, to such an extent that at one place the water flows tumultuously between them and we had to make a short portage across an island. The river then narrows at the spot where the last portage is situated and Lake Pletipi is reached by passing between many well wooded islands : but is is only after a couple of hours walk from that point that the vast sheet of water of the eastern part of the lake appears to our eyes in all its extent.

LAKE PLETIPI

Lake Pletipi is classed by Mr. Low, director of the Geological Survey of Ottawa, as one of the largest lakes of the Province. Its shape is very irregular and its contour measures 210 miles. This long perimeter is due to the fact of its having many immense spits of land with very extensive and deeply indented bays between them. The lake consists of a central sheet of

Falls above Kettle Rapid—Rivière aux Outardes (anorthosite cliffs.)

Grand Rapid on Rivière aux Outardes (outcropping of gneiss)

water from which extend five large main bays containing a multitude of others; three of these large bays lie to the south and the two others to the north. The central sheet is about nine miles from east to west and four and a half miles from north to south between the points of the two spits, but the length of the lake, measured from the head of the south-western bay, is 30 miles while it is 15 miles between the extremities of the two northeast and southeast bays. At each end of these four bays are rivers, those on the north being inlets and those on the south, outlets : the largest are those on the east, one being the source of the Rivière aux Outardes.

The whole lake and the bays are dotted with many fine islands, most of which are well wooded while others are merely outcroppings of rock or piles of boulders and they are often a considerable distance from the shore, making navigation at night somewhat dangerous. As a rule, the lake does not seem very deep, judging by the many projecting pieces of rock that appear pretty nearly everywhere ; but no soundings could be taken owing to the wind that blew continually while I was there and which made such work impossible with our little canoes. In any case the shores drop into the lake with a very slight slope : they consist chiefly of white sand or rounded boulders which makes it very difficult for canoes to approach them when there is any sea.

The shores of the lake are generally well wooded with white and black spruce, banksian pine, tamarack, black and yellow birch, mountain ash, balsam fir etc. These trees are small and frequently much bent towards the south, which is probably due to the north-west wind, the prevailing wind here. The soil, which is covered with thick moss, in sandy and rocky ; the land on the west and south sides of the lake consists of vast swampy plains frequently covered with low banks of sand which generally rise a little as they recede from the lake; but no mountain is visible on those sides. On the north side the mountains are closer, but the vast spit projecting towards the south forms fine flat land covered with a very dense forest and the soil must be very suitable for cultivation. The east side of the lake is swampy as a rule and covered with mounds of sand as far as a chain of mountains running from north-west to southeast, situate five or six miles from the lake. While making an attempt to cross that chain of mountains and to reach the Matonipi, I came upon several small lakes in the low-lying land in the vicinity of Lake Pletipi. The whole region here is well wooded. After losing some time owing to the wind on Lake Pletipi, we crossed it and proceeded towards the Shining Mountain, ascending the western inlet which forms a rapid for half a mile before falling into the lake. This rapid is avoided by a portage without a trail, on the south side. We then crossed a small lake a mile and a quarter long on the west and returned to the river, which is about three hundred feet wide, without any current, for two miles and a half, the direction being westerly : then it turns towards the north with a rapid a mile and a quarter long to Lake Oskasqueogomats (New Wood), the portage being on the east side through a dense wood full of over-

turned trees. The land is level and well wooded as a rule with a soil covered with white moss and apparently good. From the head of the portage a stretch of about two miles to the west takes us to half a mile from Shining Mountain which consists of several peaks surrounding a small plateau. The general aspect of the land from Lake Pletipi differs from that above described; the mountains have again made their appearance; those on the north are rounded and from seven to eight hundred feet high; their summits are bare and covered with reddish moss; the remainder of the country is well wooded, especially the southern part. Lake Oskasque-gomats lies south-west to south-east in its greatest length which is three miles and a half and it is about a mile wide. It is a fine lake, dotted with several round islands and seems to be very deep; in many places the shores are rocky and fall into the water with a steep slope.

Shining Mountain.—Nothing very shining was observed in drawing near this famous mountain whose summits are seen from Lake Pletipi: it is true that the weather was very cloudy while I was there and, beside the clouds that hid the sun, dense smoke brought down by a west wind and due probably to forest fires, kept us in half darkness. On that account no photograph could be taken, which is unfortunate for the view in some places was splendid.

The name may be due, not to the shiny appearance of the rock which is black or dark green, but to the many blocks of white or greyish quartzite distributed pretty much everywhere on the highest spots. The various heights of the mountain present few cliffs, the summits are generally rounded and bare with a fringe of fine timber on the flanks and on the valleys. I was unable to corroborate the Indian's version that the name "Shining" comes from the crystals of iron ore, of which they think the mass consists, shining in the sun. Probably the Indians who have no idea of mineralogy, deceived by the change of formation that takes place at the mountain, have taken for iron ore what is really but dark green pyroxenic rock. The panorama is very extensive as seen from the top of this mountain which overlooks the surrounding country; to the south-east is the immense plain of lake Pletipi and to the south wooded and level land extending as far as the mountains visible on the horizon, while to the north is an uninterrupted chain of irregularly shaped mountains, more or less bare, to the height of land, thirty miles further back.

From there I proceeded to the eastern inlet of Lake Pletipi which I explored, ascending it for some miles. It is a fine river from three to four hundred feet wide running in a northerly direction through a low and well wooded valley. It seems of much greater size than the western one. Then I came back.

While ascending, I tried to get to lake Matouipi by passing by the Long river to examine the iron deposits reported by Mr. Low, but, through an error of my guides, I was unsuccessful. The Long river is nothing but a series of

Falls above Burnt Island Lake—Rivière aux Outardes.

North-East Bay, Lake Plétipi.

small lakes, the largest of which, three miles long, is at the upper end. They are separated by small rapids necessitating many portages.

It is not very probable that this river is the outlet of lake Matonipi, as was supposed, for, at the point where I left it, it is reduced to an insignificant stream which can drain only a small area. I proceeded about twelve miles from the confluence of the Outardes, in a northeasterly direction. The whole district of the Long river, which might rather be called a labyrinth of lakes, is the same and poor as a rule ;the timber consists of evergreen trees, but they are small and chiefly black spruce, banksian pine, tamarack with a few fir and white birch. The soil is swampy or sandy on the hills and is almost everywhere covered with angular or rounded rocks, in such numbers in some places that one can walk on them without touching the drift. The surface everywhere is carpeted with thick white moss which keeps the soil damp. To the east of the series of lakes visited is a mountain of little height and rounded which is well wooded with spruce and banksian pine.

GEOLOGY

The whole of the land I visited consists essentially of crystalline strata or masses of eruptive rocks, comprising the mass of archean rocks and belonging to the upper or lower Laurentian formation. This formation is characterized by more or less schistous micaceous gneiss, the syenitic gneiss sometimes turning to quartzite, hornblendic rocks, etc. Oxydes of iron are often found mixed with the mass. The upper Laurentian is represented especially by anorthosite, a rock essentially feldspathic, more or less decomposed in some places and often containing titanic iron. The masses are generally intersected by veins or dykes of pegmatite and frequently the formation is upset by masses of acid or basic eruptive rocks

The surface earth consists chiefly of stratified clay and sand covered with boulders of the same nature as the rock constituting the formation.

For the geology of this part of the route which includes the Manikuagan river, we refer to Mr. Low's report, published in 1897.

Portage route between the Manikuagan and Outardes rivers.—The first outcropping observed is on the mountain bordering the valley of the river where a greyish syenitic gneiss, fine-grained and very quartzous, outcrops in large masses intersected by veins of coarse-grained pegmatite containing magnetic iron in small pockets distributed in the vein.

Another observation was made in the southern part of the second Lake where there is an immense development of gneiss similar to the foregoing. Few outcroppings were observed along this route, although it passes through

mountains to lake Rognon, but the boulders distributed here and there in the valleys and which are of local origin, indicate that the formation is the same.

On the west side of lake Rognon, near the Gorge, is a cliff rising almost vertically from the lake; the rock is red and pink gneiss containing small grains of magnetite enclosed in the mass; the surface is more or less rusty. As far as the Rivière aux Outardes, I noticed, in spots, greyish micaceous gneiss with a well marked stratification and in black, white or red layers, with large veins of pegmatite containing crystals of whitish feldspar and quartz also containing biotite. At some places the gneisses are very quartzous and turn to quartzite of a pale pink colour. The valley of the Rivière du Milieu is shut in between two mountains of gneiss; that on the east having a greyish black surface with bare spots; that on the west being covered with a coating of rust, which gives it a dark red colour. This valley consists chiefly of thick beds of stratified clay.

Rivière aux Outardes.—Several outcroppings were observed on the banks of this river below the first portage: gneisses, streaked, micaceous and quartzous,, are interstratified with other gneisses, more quartzous and of a blackish colour, containing grains of magnetite.

At the first and second portages, the rock is well developed; it has a massive appearance and a gneissic structure, well marked in places, with a greyish or rusty surface. Many small veins of quartz run through the mass.

From the second portage to Steep portage, many outcroppings are seen pretty much everywhere and the general character is the same: syenitic gneiss, sometimes pretty well streaked, with a greyish or reddish surface, the latter colour being especially in the places where the rock is washed by the water draining from the adjacent land: almost everywhere dykes of pegmatite or veins of quartz intersect the formation. These dykes contain well defined crystals of biotite and of quartz enclosed in a reddish feldspathic paste.

At the confluence of the Beaver river and the Rivière of the Falls, the latter being about 135 miles from the sea, the mountains of gneiss are cut in abrupt cliffs and show massive rock with a blackish surface. About two miles below the Hare's Head river is a large development of yellowish gneiss, medium grained and very quartzous interstratified with finer-grained rocks containing many crystals of red garnet about the size of a pea and of another rock containing hornblende and black mica; the surface is dark grey and frequently rusty; the whole is intersected by large veins of pegmatite. In the bend of the Hare's Head river and higher up, the east wall of the channel is cut vertically in similar rock. The river banks as far as here very often consist essentially of round boulders a foot in diameter, more or less, and of different origins.

At the third or Steep portage, the river below the main rapid falls some forty feet, passing over a mass of reddish and pink gneiss polished by the water and intersected by veins of essentially feldspathic rock showing fine crystals. Crystals of red garnet are often found; direction N. 80° E.

The rock at the fourth portage is, as a rule, a very quartzous greyish gneiss fine-grained and interstratified with a black micaceous gneiss. There are strips consisting almost entirely of quartz, strongly charged with small crystals of red garnet; direction N. 80° E.

The outcroppings as far as the Kettle portage are numerous and always retain pretty much the same character: gneiss more or less distinctly streaked, with a greyish surface, and masses of syenitic rock with many boulders of anorthosite, distributed pretty much everywhere along the river. About the 149th mile is a development of gneiss with coarse grains of quartz and feldspar intersected by dykes of pegmatite sometimes containing amber mica. Below Kettle portage, a dioritic gneiss outcrops, the chief constituent of which is hornblende giving it a dark greenish black colour: it is intersected by many small veins of pinkish pegmatite.

On the plateau of the Kettle portage outcroppings are rare, but the large blocks of rock scattered over the surface indicate an approaching change in the formation. The rock is a white feldspathic cement containing large black crystals, probably of anorthosite. At the head of the portage, the walls of the channel are cut in a mass of anorthosite of which there is an immense development at that spot; it is intersected by ordinary streaked gneiss and fine-grained dioritic gneiss similar to that noted below the rapid. Small veins of pegmatite intersect the mass in every direction. This anorthosite is not in layers and its surface is blackish; its cleavage sometimes shows fine reflections; it is often more or less decomposed and sometimes the feldspathic rock is white and contains large black crystals similar to those seen along the portage.

As far as the widening of the river, a few miles higher up, many outcroppings were examined with the same result except that the anorthosite is everywhere in a more compact state and more general. From the widening to the confluence of the river of the White Mountain, very few rocks are exposed in the immediate banks of the channel although the steep mountains are not far off; but, at the confluence, the mountains have closed in and very fine cuttings of rock are visible; the anorthosite is more or less decomposed here and contains shreds of blackish dioritic gneiss. In the next four or five miles many outcroppings of similar rock are visible, but higher up more is observed as far as the foot of the great rapid some ten miles above the great bends where the gneiss re-appears. The mountains, as far as Hell creek, are high and more or less steep; their appearance is picturesque which would seem to characterize the anorthosite formation; further up they are rounder

and not so high ; it is probable that the contact of the anorthosite with the gneiss is about the great bends.

From the foot of the Great rapid to the starting point towards the Owl river, the outcropping are numerous. The rock is a micaceous gneiss more or less quartzous, frequently interstratified with blackish dioritic gneiss. About the middle of the rapid are fragments of dark green stone consisting entirely of crystalline hornblende imbedded in a very twisted quartzous matrix : direction N. 35° W. At the starting point of the portage is a considerable outcropping of greyish streaked micaceous gneiss ; direction N. 22° E. All along the rapid, the bed of the channel is covered with boulders of very variable size and coming from the adjacent formations.

About the middle of the portage between the Outardes and Owl rivers a considerable development of rock is exposed ; at first it is a very quartzous streaked gneiss with a whitish surface interstratified with another blackish, fine-grained gneiss, direction N. 45° W. ; then there is a thickness of about 400 feet of a gneissic rock, with an ochreous surface of a dark colour, probably peridotic transformed into hydrated products, a little being serpentine ; it also contains a little disseminated fine-grained magnetite mixed with the whole mass. On the other side there is also a micaceous gneiss ; direction N. 3 ° W. Further on are still other outcroppings of rock slightly magnetic similar to the strip mentioned above.

On the Owl river no outcropping of rock was observed except below the last rapid just above the widening by which the river falls into the Rivière aux Outardes. The rock exposed at that place is a mica-schist with a yellow cleavage ; the quartz is sometimes in fairly large pieces ; the surface is grayish verging on black, direction N. 2° W. At the first portage above the confluence of the Owl river, greyish micaceous gneiss outcroppings were also seen as far as the confluence of the Long river ; sometimes the mass assumes a pinkish colour of granitic texture ; gneiss is visible above the fall at the head of Burnt Island lake, direction N. 45° W. The next observation was made at the second portage of Burnt Island lake, where a micaceous gneiss, intersected by granitic masses with veins of pegmatite, outcrops. Above this portage no outcropping was observed along the river as far as Lake Pletipi : in the rapids, the water flows through detached pieces of rock showing, however, that the formation must be gneissic and syenitic.

On the northern part of the great spit of the south-east, is a considerable outcropping of micaceous gneiss with biotite. The shores of the lake at that spot are covered with round boulders of various kinds : blocks of pegmatite, coming probably from neighboring dykes, were observed containing large pieces of specular iron, small crystals of black mica and of red garnet. No other outcropping was observed on the shores of the lake which are formed of boulders and fine yellow or white sand. In many places, even about the

middle, the lower part of the north-west bay is streaked with strips of boulders barely showing at the surface of the water. At the head of this bay a yellowish syenitic rock, at times talcous, is exposed.

Many outcroppings were observed on the west side of the small lake a few hundred yards north-west of Lake Pletipi ;the rock is of a dark green colour; it consists of pyroxene more or less decomposed in hydrated products and chlorite. The same formation was identified in several places as far as Oskasqueegamats, but on the shores of that lake the rock is often streaked with small lenticular veins of quartz and sometimes the gneissic structure is well marked ; direction N. 60° E.

Shining Mountain the height of whose summits varies from 1,000 to 1,200 feet above the lake, consists essentially of a dark green or black rock consisting of pyroxene (augite) : several observations at various points showed the same formation. On the inner plateau of the mountain is an immense development of a white quartzite with light green tints and which seems, at times, to contain a little talc. This quartzite assumes a dark red colour at the surface where it is washed by water. Pieces of this rock were observed even on the highest points of the mountain.

The following observation took place on a small island in front of the large spit on the north of Lake Pletipi where a greyish micaceous gneiss outcrops. No rock *in situ* was observed at the N. E. inlet of the lake, which flows over a thick layer of drift, at its mouth. On the west side, an immense bank of fine sandy barely covered with water advances some hundreds yards into the lake. On the east side, about two miles from the shore, towards the mountains, I observed a greyish micaceous gneiss ; direction N. 40° E. Several other observations were made on the islands on the east side of the lake where micaceous gniesses, sometimes dioritic, outcrop; direction N. 25° E. Veins of pegmatite intersect the mass of rocks.

Very few outcroppings are observed on the low-lying and swampy land adjoining the Long river, but many pieces of rock distributed pretty much everywhere show that the formation is essentially gneissic.

ECONOMIC MINERALS AND OTHER RESOURCES OF THE COUNTRY

The only ores observed are iron ores ,traces of which are met with everywhere along this distance and are chiefly in the form of magnetite.

In the portage between the Outardes and Owl is an immense development of a gneissic rock containing disseminated magnetite in small quantities. It is true that in that state and under present conditions as regards treating, this deposit, as seen, could not supply material for profitable operations, but

it is possible that more thorough searches would lead to the discovery of large and more concentrated deposits, for it would seem that this formation is similar to that reported by Mr. Low on the Mooshaulagan river where, he says, there are inexhaustible deposits of good iron ores.

Black sands, considerably magnetic, are found in many places on the beaches of the rivers, especially at the Chesnicup rapid on the Tootnustook river and below the first small portage of the Rivière aux Outardes. In those places there is a certain quantity mixed with the ordinary quartzous sand which is often very garnetiferous.

Some small pieces of iron pyrite were observed on the banks of the Long river and at the Grand Rapids of the Outardes.

The other resources of the country are chiefly timber, water-powers, fish and game.

A good deal of timber of merchantable dimensions is found along the routes I followed. The North Shore will assuredly become a centre of lumbering operations in the territory two or three hundred miles wide adjoining the Gulf. It is true that vast areas of that portion of the North Shore have been swept by fire, but the greater part is still in virgin forest, and awaits but the lumberman's axe. For details see the description of the routes followed.

All the lakes and rivers are well stocked with fish of various kinds, the chief ones being pike, maskinongé, grey trout, carp, speckled trout, white fish, etc. Maskinongé and pike were the most plentiful on the Manikuagan and Outardes rivers; some were caught weighing from 5 to 7 pounds. On Lake Pletipi and adjoining lakes, grey trout, carp and maskinongé were the most plentiful; some grey trout weighing from 8 to 10 pounds were caught. Speckled trout weighing about half a pound were caught especially in the lakes of the portage between the Manikuagan and Outardes rivers.

Game birds and animals are very plentiful everywhere and were properly appreciated as a change in our menu which would otherwise have become monotonous. Ducks of all kinds are found everywhere on the lakes and rivers and wild geese in the northern part. A good many spruce and birch partridge were killed in the portages. There are large numbers of hawks, owls, fish-eagles, king-fishers and loons.

The fur-bearing animals whose traces we distinctly noticed are: bear which is plentiful everywhere, foxes of various kinds, beaver, otter, mink, marten, weasel, lynx, fisher etc.

WATER-POWERS

Many falls forming considerable water-powers are met with on the Manikuagan and Outardes rivers as may be seen by the description of the routes.

The first falls of the Manikuagan have an available height of 87 feet, according to Mr. Chs Ed. Gauvin, superintendent of surveys. The flow of the river at that point, according to the report of the Department of Lands and Forests for 1901, is 2,422,447 cubic feet per minute and 1,650,000 feet according to the engineers of Mr. DeLorimier who has leased these falls for 99 years. If we take the average, we have 2,036,228 cubic feet per minute. This fall may thus have a capacity of 334,000 horse-power.

At the second portage of the Manikuagan, about ten miles above the first, there is a difference in level of the river of about 160 feet in a distance of a mile and three quarters ; as the flow is practically the same, it follows that about 500,000 horse-power could be developed there.

At the Chesnicup rapid, the difference of level is about 100 feet in a half mile and the flow, although slighter than at the first falls is still very great and I think I am on the right side in saying that the water-power there has a capacity of at least 250,000 horse-power. Higher up on the Manikuagan river are many and very considerable water-powers, but I did not inspect them. All the above figures must not, however, be considered as minimum figures.

There are also many falls on the Rivière aux Outardes ; in the first place according to the official report of Mr. Chs.-Ed. Gauvin, superintendent of surveys, published in 1908, that by which it falls into the sea, is 181 feet high over a distance of a mile and a half, and the minimum flow is 2,884 cubic feet per second, giving a capacity of 59,187 horse-power.

If we look at the map we find that rapids and falls and, consequently, water-powers are numerous between this falls and the upper portage between the Manikuagan and Outardes rivers.

Higher up, several falls are passed which may have a capacity of some thousands of horse-power and about the 144th wide from the sea, is the Steep portage where the difference in level of the river is about 80 feet in about 120 yards. If we consider that this point is about the middle of the territory drained by this river, we shall have an approximate idea of the flow by taking about one half of what it is at the month of the river and I think we are on the safe side for the drained territory further north seems larger than that further south. Thus we have a flow of about 1,400 cubic feet per second and this fall would therefore have a capacity of over 13,000 horse-power.

The Kettle rapids, comprising several falls would also supply a water-power of very considerable capacity.

The rapids and falls avoided by passing the Owl river are also worthy of mention as are also those above Burnt Island lake.

Report on an exploration, in the region of Lakes Chibougamau, Doré, David and Asinichibastat.

By E. DULIEUX, Mining Engineer

The present work contains the results of a two months' trip from the 8th August to the 8th October, 1908, during which I visited Lakes Chibougamau, Doré, Simon, David, Asinitchibastat and Bourbeau. It is divided into three parts.

I. Description of the regions traversed; their physical geography; forest resources; agricultural possibilities.

II. Geology of said regions.

III. Description of the prospecting works done in the region of Lakes Chibougamau, Doré and Bourbeau.

I. DESCRIPTION OF THE REGION TRAVERSED

As these regions have already been described in detail as the result of explorations made both by the Geological Survey of Ottawa and the Government of the Province of Quebec, I shall confine myself to noting certain observations which I made along the route and which are calculated to throw light upon the resources of the country leading to Lake Chibougamau.

From Roberval to the River Chigobiche.—The route follows the river Chamouchouan, the first half being made by waggon by way of the villages of St. Prime and St. Félicien, Le Doré to the confluence of the river aux Trembles. This road avoids 32 miles of river and 7 portages, and possesses the advantage of saving 3 portages over the road formerly followed to portage à l'Ours.

The distance by the canoe route between Roberval and the Chigobiche is 66 miles, while, as the bird flies, it is only 50 miles .

In this distance, the valley of the Chamouchouan may be divided into two parts of entirely different aspect. From Roberval to the foot of the Piémonka rapids, or for a distance of 30 to 35 miles as the bird flies, the river flows between sandy and clayey bluffs and the lands spread out to the right and left in slightly undulating plains. From the Piémonka rapids to the head of the falls of the Petite Chaudière, the Chamouchouan flows on the contrary between high rocky hills, forming for a distance of 20 to 22 miles an unbroken series of rapids and falls.

It is certain that the Chamouchouan thus follows the route formerly followed by the waters in the Champlain epoch. Between the present falls of the Chaudière and the Piémonka rapids, these waters encountered a barrier of granites and Laurentian gneiss which they could not overcome except by breaking through it. They accordingly dug out for themselves a principal valley, the bottom of which is to-day occupied by the Piémonka, Epinette Blanche, Chapleau and Chaudière rapids, depositing below these passes beds of clay and arkose, whose precipitation was due to the slowing of the waters, which then spread out into lakes of great extent. Almost everywhere else, these quaternary sediments present two distinct beds or layers, one of clay at the bottom and the other of coarse arkose above, which suggests the belief that, after a tranquil lacustrian period during which the clay was deposited, there came a movement of upheaval, pretty slow no doubt, which brought about a change of level in the base of the waters and provoked the rupture by them of fresh barriers of Laurentian granite, whose debris have accumulated in the form of arkose. The result is that, from Lake St. John to the foot of the Piémonka rapids, the present river has hollowed out its bed in friable land, and shows great stretches of dead water. The adjacent region is exceedingly well adapted to settlement in view of the considerable depth of the clay and the sandy clays which form the sub-soil and which retain the moisture so favorable to vegetation. And, as a matter of fact, although the railway is very distant from them, clearings are met with as far as the river aux Trembles. The principal timber is aspen and white birch, together with elm, willow and ash on the banks and on some of the islands. The trees do not attain large dimensions; they grow too thickly and too closely; but on the whole these forests will offer to settlers excellent resources in the way of lumber.

On the other hand, the region extending from the foot of the Piémonka rapids to the head of the Chaudière falls appears to be poorly suited to agricultural settlement. The whole forms an undulating plateau, cut up by shallow ravines, and whose altitude varies between 200 and 300 feet above the level of the river. This plateau is made up of Laurentian gneiss and granites covered by a thin coating of vegetable soil. At some points, the river cuts again through bluffs of sand and gravel from 3 to 15 feet in height, but whose extent is limited. With the exception of a region which stretches for six miles

along the river to the head of L'Epinette Blanche rapids, where the spruce and the white birch attain a good size, all the wood is of second growth and even much of it has been burned recently between the Pas de Fond and the Piémonka rapids.

From the Forks of the River Chigobiche to Lake Chamouchouan by the River Chigobiche.—The river Chigobiche and Lake Chigobiche form the shortest road to reach Lake Chamouchouan and we took this road in going up.

The river Chigobiche (about 25 miles) flows in its first eight miles between rocky hills of gneiss, whose summits show the bare rock. Between these hills some strips of good vegetable soil are found. The forest is composed chiefly of aspen in the parts made up of mellow soil, of banksian pine on the sandy slopes and of small sized, but pretty thickly growing spruce on the hill sides.

From the 8th to the 14th mile, the valley widens out and the hills give place to an unbroken plain showing some tracts of good land, but, generally speaking, swampy. Many of the portages are made through marshes. The timber is all of second growth in the spots that have not been recently burned over.

During the last 3 miles, the plains disappear and the river presents a succession of small rapids obstructed by boulders, although the banks are formed of hills of 100 to 400 feet high, wooded with stunted banksian pine and spruce.

Lake Chigobiche is an elongated sheet of water some 20 miles in length and whose greatest width does not exceed 2 miles. The canoe route follows only the first part of this lake, which has a S. E. N. W. direction for 12 miles. By means of a portage starting from the head of a sandy bay, a tortuous river called the river Croche is reached, which leads to Lake Chamouchouan.

The southern part of Lake Chigobiche is surrounded by hills 200 to 600 feet in height and covered on the eastern shore by handsome forests of aspen and spruce. Towards the north, the shores become lower and consist of terraces of modern alluvions made up of rolled pebbles mixed with granitic sands forming a sub-soil of medium fertility.

The trees are all of second growth. The portage between Lake Chigobiche and the river Croche is over a plateau of fine sand forming a watershed between the waters of the Chigobiche and those of the upper Chamouchouan. The predominant woods are banksian pine and black spruce of small dimensions.

The River Croche flows through a low swampy plain mostly in marsh. The wood is of no value; a recent fire has swept this region and, in the unburnt parts, the tamarack, which constituted a notable part of the bush, have been killed by an invasion of the saw-fly and of these fine trees only the bare skeletons remain.

Lake Chamouchouan extends from S. E. to N. W. for a length of about 10 miles with an average breadth of 1 mile. Its shores are not high, but are protected by natural shingles of pebbles piled up by the ice in the spring freshets. They rise towards the west by easy slopes towards some hills of slight elevation, which bound an unbroken plain. Except a few rocky promontories, the shores of the lake show a soil adapted to agriculture, especially in approaching the river Nickabau. The bush is pretty thick and comprises alternating masses of white birch and aspen on the one hand and of spruce on the other.

River Chamouchouan between its confluence with the Chigobiche and Lake Chamouchouan.—Notwithstanding the great roundabout which it makes. this route was the one we followed in coming down, as it was the only one practicable in the low stage of the water that autumn.

The river Chamouchouan is the discharge of Lake Chamouchouan. On leaving the lake it flows N. E. for a distance of 18 miles, then turns abruptly to the S. E. to receive the Chigobiche 40 miles lower down. Its valley presents still more clearly than that of the lower Chamouchouan, the phenomenon of soils of the Champlain period alternating with rocky passes corresponding to the present rapids. Thus on leaving Lake Chamouchouan, after flowing for about 8 miles between low banks formed of modern alluvions, the river narrows in between rocky hills of no great height and for about 10 miles shows only an unbroken succession of rapids, of which the Laurentian granites and gneiss form the base. After the Sauce Mattawin, the last of these rapids, the granites yield to boulder clay, then to terraces of sandy clay, through which the stream has cut for itself a quieter bed. Here again are seen the materials dropped towards the close of the glacial age and especially during the Champlain period by the waters which opened for themselves a path, not only through the barriers of gneiss, but also through the moraines left by the glaciers when they definitely retreated. As along the lower course of the Chamouchouan, so are found here several series of terrace deposits corresponding to the changes of level in the system of the waters. This phenomenon is clearly visible on the river du Chef where there are two series of terraces from 40 to 70 feet over the river level.

For a second time, starting from the river à la Loche, the hills come closer together, and the terraces disappear to make way for the Laurentian gneiss and the rapids. Once this series of hills has been passed, the

river flows again in a quiet bed between sandy banks as far as the forks of the Chigobiche and the head of the Petite Chaudière rapids. In principle, the terrace parts correspond to lands favorable to agriculture and whose fertility may be compared to that of the banks of the Lower Chamouchouan towards the village of Roberval. The superficies of these lands is on the other hand pretty small as far at least as I could see from the river. The hills, bordering the rapids, have only a very thin covering of vegetable soil.

The timber is nearly everywhere of second growth and is later than the great fire of 1868. I noted, however, for 4 miles along the river and almost to the river du Chef, fine forests containing spruce and white birch of very large diameter. Among the second growth forests, there are many that have been swept by recent fires.

Delta of the River Nikabau.—Under this name is comprised the region stretching from the north shore of Lake Chamouchouan for about 2 miles, the banks of the river Chamouchouan for 5 miles and the banks of the river Nikabau for 7 miles. This region must also be prolonged for a certain number of miles to the west towards the river Miskaukau which seemed to present the same conditions.

This region as a whole consists of quaternary alluvions, chiefly argillaceous, but slightly wooded along the banks of the river, yet embracing some tracts of good spruce forest towards the interior. The land is swampy at the immediate confluence of the Nickabau and the Chamouchouan, but shows an excellent soil in the interior for cultivation, in fact, the best seen by me from Piémonka to Chibougamau.

From Lake Chamouchouan to the Watershed.—The river Nikobau, which is followed on leaving Lake Chamouchouan, flows as already stated for the first 7 miles through modern alluvions. Starting from Two Portages, a few slight undulations appear and a series of rapids begin, by which we rise from 1110 to 1150 feet in 14 miles. This second part of the river Nickabau comprises fine forests of black and white spruce accompanied by balsam fir, banksian-pine and white birch. In many places, these would yield 25 to 30 cords of pulpwood to the acre. The soil seems to be of average fertility.

The same uniformity is observable around lake Nikobau, whose low shores are wooded with poor forest made up mostly of spruce.

Leaving Lake Nickabau, a series of lakes is encountered strung out like beads and separated from each other by rapids streams (Lakes Jourdain, Rat Musqué, aux Deux Loutres, aux Huards, Long) until Lake Poisson Blanc and the watershed are reached by a long marshy portage. This country, of which certainly more than one half is under water, presents the characteristic aspect of high granitic plateaux long emerged and subjected to glacial erosions,

which, in wearing down the too marked prominences, left after the departure of the ice a plateau without defined slopes, whereon the waters accumulated in small lakes and marshes emptying one into the other by means of small streams. The boulder clays which had been deposited in front of the glacial moraines, as, for example, below the Sauce Mattawin, are lacking here in general so that the rock is covered only with very little vegetable soil and offers very few attractions to agriculture. Most of the bottoms are formed of marsh or natural swamp meadows. There are some good lands especially in the neighborhood of Lake Rat Mauqué.

The forests are fine, although certain parts have been recently burned. The environs of Lake Jourdain are wooded with heavy spruce which would yield 30 to 40 cords of pulpwood to the acre. I may mention also the slopes to the west of Lake Long, which are clothed with white birch and spruce of good size and a few cedars of no great value, it is true, and the heights forming the S. E. shore of Lake Poisson [illegible].

From the Height of Land to Lake Chibougamau.—Starting from the watershed, the route involves 4 portages and difficult navigation for large canoes in rivers and small marshy lakes before reaching Lake Obatogamau. The general aspect of the country continues the same: swamps, marshes and natural meadows in the bottoms and on the high grounds spruce, banksian pine, swamp pine, white birch and also some young tamarac that have sprung up since the invasion of the saw-fly. In fact, these regions still show many skeletons of old tamarcks.

Lake Obatogamau is a type of the lakes of the granitic plateaux subjected to long glacial erosions. It presents no definite shape with deeply indented narrow bays not yet scaled, which explains why no exact map of them has yet been drawn up. This shallow lake is on the other hand encumbered with large and small islands which so limit the water horizon that it is difficult to cross it without guides amidst these islands and promontories of the main land, which form a real labyrinth. Most of these islands and points are handsomely wooded with second growth and at some points the original forest still exists. Spruce predominates and it may be stated that the shores of this lake form a reserve of pulp wood that could be easily worked.

From Lake Obatogamau to Lake Chibougamau.—The country resumes the same aspect as in the neighborhood of the watershed. The streams followed by the canoes flow in winding beds through low, swampy lands of little value, while, in the marshes and on the small rocky hills rather thin woods of banksian pine, spruce, white birch and aspen are visible. Much of this timber has been recently burned.

Sojourn in the region of Lake Chibougamau. As the chief object of my trip was to visit the prospecting works in this region, I confined my explora-

tions to the parts noted as mineralized. I thus visited all the northern part of Lake Chibougamau, not only following in a canoe the shore of the Portagfe, McKenzie and Des Isles bays, but traversing the bush on foot and ascending the heights of the Sorcerer, the Juggler and the Cuming mountains. By the line separating the townships of Roy and McKenzie, I reached Lake Bourbeau, which I scaled aproximately with the compass. I then visited the different prospecting works at Lake Doré and tried to reach Lake David by the land route which connects two long bays of Lakes David and Doré. I found that these bays were not as deep as shown on the map. They end very abruptly in streams that are hardly navigable by canoes and we had to make 6 portages before reaching Lake David. Still this route is the shortest from Lake Doré to Lake David.

Continuing the descent of the river Chibougamau, we reached lakes Simon and Asinitchibastat, carefully inspecting both banks of the latter to nearly a mile above the line dividing the townships of Blaiklock and McKenzie. On our return, we followed the same route by way of lakes Simon and David except that, instead of taking the short-cut between lakes David and Doré, we ascended the river Chibougamau and entered Lake Doré by way of its southern bay.

As regards elevations of the soil, this region may be divided into two parts:

The first, which lies to the north of lakes Simon and David and comprises the surroundings of Lake Bourbeau from McKenzie bay and bay des Iles alone shows a few hills of any size. The highest seems to be the Cuming mountain to the west of McKenzie bay, which rises to over 700 feet above the level of the lake. It forms part of a chain of hills which includes the Juggler and Portage mountains and which extends to the S. W. as far as Lake Bourbeau. In the same way Lake Asinitchibastat is bordered especially on the S. E. side by a series of high hills which run from N. E. to S. W. The ascents which I made of Cuming and of the highest summit of these hills towards Asinitchibastat show that the whole region between Asinitchibastat and Doré is mountainous. A remarkable fact is that all these hills run nearly parallel N. E. S. E. They impart to the water system a characteristic direction. Thus lakes Chibougamau and Asinitchibastat extend from N. E. to S. W. and the river Chibougamau itself flows sometimes N. E. and sometimes S. W. as if a series of parallel obstructions prevented it from flowing directly towards the Nottaway river.

The sub-soil is composed of boulder clay in the valleys and depressions between the chains of hills, while the hills themselves show only a slight covering of earth under the moss. Some of these valleys might bear certain crops (potatoes, vegetables, oats). In any case, this country on the whole would furnish good pasture lands.

The forests of this region are among the finest we met and the entire surroundings of Lake Bourbeau (township of McKenzie) are densely wooded with the original growth. The predominating woods are the different kinds of spruce, the balsam fir, the white birch and the aspen. Spruce and white birch of large diameter are frequent. According to our guides these forests should turn out 25 to 30 cords of pulp wood and 20 to 25 cords of hard wood to the acre.

The second region, which is situated to the south of lakes Simon and David and which includes the windings of the river Chibougamau on leaving Lake Doré is on the contrary a region without any marked elevation and is made up of plains which are more frequently marshy and from which rise up a few small rocky hills.

The soil is formed of boulder clay or swamp muck.

The woods are in general of little value. They are all of second growth and some were recently burnt. Some strips of the old forest remain, however, especially towards the narrows between lakes Simon and Asinitchibastat and to the south of Lake Simon.

II. GEOLOGY OF THE REGION

This region was very thoroughly studied geologically by Mr. A. P. Low and described in the Geological Survey of Canada report for 1906. For the details, I therefore refer to that report. Moreover, for my part, I could gather only very little information during my brief stay in the region.

I shall give, however, a rapid sketch of the geological conditions of the country, laying stress especially on those which seem to relate more directly to deposits of the economic minerals.

From the standpoint of the engineer and of the prospector, the rocks of the region may be divided into two series.

The first, which is a series of acid rocks comprising gneiss and granites (Laurentian rocks, black micaceous granite, amphibolic granite). It is the barren series, the one which, short of later discoveries that are not very probable, contains none of the useful minerals referred to hereafter (sulphur, magnetite, asbestos). These rocks are easily recognized. Generally, the grains of which they are composed are visible to the naked eye, of a pink or white color, with black grains.

The second is a series of a basic rocks and comprises the gabbros, talco-schists, magnetic diabase, chloritic schists and conglomerates. This is the productive series, the one in which the hope of finding something may be entertained. A common characteristic of these rocks is their dark green color.

The relative age of these rocks will be more difficult to fix. But for the engineer this is not a question of supreme importance. The actions of subsequent metamorphism, of secondary alterations through pressure (diabase made schistous) or through heat (fissures due to shrinkage with filling of serpentine or magnetite) or through the circulation of steam (injection through fissured rocks) are of more immediate interest from the economic point of view. Here, however, is an approximate classification of these rocks.

Keewatin.—According to Mr. Low, this would be represented by a portion of diabase, although it cannot be asserted that such diabase belongs rather to the Keewatin than to the Lower Huronian. The existence of a sub-soil of Keewatin is manifested by the presence in the Lower Huronian conglomerates of pebbles of schistous diabase, which must have been wrenched from the rocks of the Keewatin period by later erosion and embedded at the same time as the granitic boulders in a cement of volcanic origin contemporaneous with the Lower Huronian.

Laurentian.—To the Laurentian would appear to belong some of the gneiss of the river Chibougamau the hornblendic granites to the south of Lake Chibougamau and the west of Lake Simon. It is these rocks which have supplied the granitic boulders of the conglomerate associated with the Lower Huronian.

Lower Huronian.—Under this head is ranged a series of rocks, whose common characteristic is extreme richness in magnesian products and which by this very fact all present a common greenish or brownish green color. This epoch, which must have been very lengthy, undoubtedly witnessed the occurrence of the phenomena of sedimentation, of which the schists of the discharge of Lake Bourbeau offer us an example, as well as of the phenomena of erosion as proven by the existence of rounded stones in the conglomerates of McKenzie bay. These periods of sedimentation were disturbed by several basic eruptive veins all very rich in magnesian products and some of which are accompanied by such quantities of ferrous products that certain masses actually contain over 50 p. c. of magnetite. These eruptions took place in the form of the melted magmas which, in crystalizing in the deepest parts, gave rise to the gabbros of the Sorcerer or which in overflowing in the open air produced rocks of fine structure, to which the general name of diabase has been given, or in the form of muds which gave birth to the more schistous diabase. The metamorphizing action of the steam which accompanied these magmatic eruptions and which transformed the contemporary sediments into rocks which subsequent alterations have rendered it impossible to distinguish from the eruptive rocks properly so called, must be added

Each eruptive newcomer turned over and bent its predecessor from which comes that foliated structure presented by nearly all diabase and which lat

Asbestos Island with Juggler's mountain on the right

Discharge of Lake Chibougamau, West of Portage Island

facilitates the transformation of the primitive magnesian products into hydrated products. Thus originated the talcose and chloritic schists so abundant along Lage Asinitchibastat. The serpentine only correspond sto a local transformation of the more magnesian parts of the primitive rocks and also the most compact. It is hard to say what were at the outset those rocks which constitute the masses of impure serpentine of McKenzie bay, Lake Asinitchibastat and Lake Bourbeau. They were probably peridotites and pyroxenites. Whatever may be the case, it may be said that the serpentinous transformation of the ancient rocks is a very frequent fact in the region which stretches from McKenzie bay, the north of Lake Doré, and Lake Asinitchibastat and that all degrees of transformation are met with from the diabase with serpentinous and talcose reflections to the compact serpentine.. Compared with the serpentines of the Thetford region, the Chibougamau serpentine is much less pure; its color is dark green or black, and with a granular fracture. Under the microscope, it shows that the cells of serpentine are surrounded with talcose bands; grains of magnetite are always met with and sometimes in considerable quantities. Some specimens show a decomposed epidote; others again crystals of calcite. Although some veins of asbestos are encountered a little everywhere in the masses of serpentine, this serpentine has not yet proved productive of workable asbestos except in the N. and N. W. regions of McKenzie bay.

Magnetic Rocks.—Throughout all the country adjacent to bay des Iles it is impossible to use the compass. The first point at which magnetic disturbances were noted forms what is termed a magnetic cone on the west shore of McKenzie bay. Other similar centres exist especially in the mountainous mass of the Sorcerer and on Portage Island, so that it may be asserted that all the rocks bordering McKenzie bay and forming the mass of the Sorcerer are magnetic rocks characterized by all the degrees between true serpentine and magnetic diabase, carrying 60 p. c. of magnetite. This magnetite so widely distributed, belongs to a formation contemporaneous with that of the rock itself and the local concentrations which appear in the form of veins must have been produced shortly after the consolidation by the simple filling of the fissures which were opened up by the shrinkage or by the settling of the magma. This consideration is important because it enables us to foresee that these veins of magnetite do not extend to a very great depth or length and that they are in no way assimilable to the veinous filling up of great fractures of the soil.

As for the metalliferous veins proper, those which carried sulphur, iron and copper with the precious metals, they seem to be localized in the regions of the folded diabase adjoining the gabbros at the northern part of Lake Doré and on Portage Island. As they are equally met with in the schistous diabase as in the gabbros, it is difficult to assert that these metalli-

ferous veins are derived from the eruption itself of the gabbros. These gabbros have, however played a rôle in this sense that it was they which bent and occasioned the foliation of the adjacent diabase and prepared a natural path for the mineralizing vapors. These vapors either filled the fractures, giving us the true lodes of quartz, some of which are auriferous, or were injected into the schistous rocks and have given us the ore bodies of impregnation and segregation which are described in detail further on.

Sorcerer's Mountain and North Shore of Bay des Iles.—Sorcerer's Mountain forms a series of elevations running S. W. N. E. and composed of a fine grained dark green or black diabase. At the level of lot 7, range IV of Roy, the crest is, however, made up of a coarse-grained gabbro which is observed on the whole of the southern flank of the chain nearly to Bay des Iles. Following the crest from west to east the proportion of magnetite is seen clearly to increase as the feldspars diminish.

In the eastern part of the mass, many veins of compact magnetite appear, which are nothing else but an altogether local secondary concentration in the shrinkage fissures of the magnetite with which the eruptive magma was impregnated. At certain points, these fissures have received a second filling. This may be seen on lot 8, range III, township of Roy, at the foot of the bay, in a prospect made about ½ a mile from the shore where a rock can be seen containing magnetite, traversed with veins of magnetite and fibrous serpentine (picrolite). Poor asbestos lines the walls of these veins or intersects them. Analysis of this rock has given:

$Si\ O_2$	28.26	say	$Fe_2\ O_3$=35.57
$Fe_3 O_4$	34.38		Iron =24.90
Mgo	26.20		
Cao	traces		
$Al_2\ O_3$	9.07		
Undetermined.....	2.09		
	24.90		
Corresponding to metallic Iron..	24.90		

On the western shore of this same bay there is also a vein half filled with plagioclase feldspar (anorthite) and fibrous magnetite mixed with asbestos.

McKenzie Bay.—The shores of this bay are formed of a serpentinous rock sometimes pretty pure as in the northern part of the bay (lots 6 and 7, range VIII, township of Roy), sometimes magnetic (magnetic cone) and sometimes showing intrusions of pyroxene and garnets. The central part of Asbestos Island is a good example of these pyroxenic and garnetiferous intrusions in the serpentine. These intrusions manifest themselves under the

appearance of a hard white rock, with a smooth fracture, which might be confounded with quartzite, but which under the microscope reveals garnets and pyroxenes accompanied by plagioclase feldspars. It is at the contact of these intrusions in the serpentine that the finest veins of asbestos occur.

Proceeding towards Juggler's Mountain and that of Cuming, the serpentine gives place to a diabase in general rich in products of secondary transformation. A specimen taken near the summit of the Juggler showed under the microscope a very fine mosaic of feldspars and magnesian elements, amphibole and epidote predominating. The summit of Cuming is formed of a hard gray rock without apparent grain and of uneven fracture and showing under the microscope large crystals of pyroxene changing sometimes into amphibole and sometimes into hydrated magnesian products. The cement is composed of epidote, zoisite, feldspars; masses of leucoxene (association of titaniferous minerals, opaque, in the plates) are frequent. I found no serpentine either on the summit or the sides of Cuming Mountain and still less asbestos as some prospectors had claimed to have observed there.

Portage Island—The predominating rock is a diabase which in the eastern part at the point of contact with the gabbro, has undergone a metamorphizing action with transformation into talcose schists, impregnations with sulphuretted metallic elements, sliding fractures subsequently filled with quartz and sulphuretted elements. As this diabase originally contained magnetite, it is not a rare occurrence to find certain rocks simultaneously containing crystals of magnetite derived from the rock itself and crystals of pyrites injected later.

Lake Doré.—The shores of this lake present successively from south to north, firstly, an amphibolic granite, then a gabbro and then a diabase similar to that of Portage Island. It is at the contact of the diabase and the gabbro that the sulphurets of iron and of copper are found in greatest abundance. In the schistous diabase the sulphurets are injected between the folds of the rock, while in the gabbros the injected elements are distributed in parallel zones, giving to the rock a gneissic appearance.

Lake Bourbeau.—The banks are made up of a diabase, now schistous and rich in talc and now compact and frequently passing into an impure serpentine. Thus at the head of the Bay du Cran Penché, a flat rock inclined at an angle of 40° and having a trend E. W. has been formed at the base of an impure and compact serpentine, which towards the middle of its height turns into a true, but bent and twisted serpentine. This serpentine contains between its folds a hard asbestos and, traversing the whole, very small veins of silky asbestos. Examined under the microscope, the rock shows in parallel light numerous grains of magnetite aligned in opaque filaments on a white

background composed of magnesian products of hydratation with the predominating serpentine, decomposed epidote and titaniferous minerals.

The sill of the discharge of Lake Bourbeau is composed of black schists with a westerly direction and a dip of 60° north. The color of these schists seems to be due to carboniferous matter.

Lakes Simon and David.—I could only visit the south shores of these lakes. The southern shore of Lake David is composed, at the mouth of the river Chibougamau of a grainy hornblendic rock containing but few white elements. Under the microscope, the feldspars rarely appear sound and are traversed by microlites of magnesian elements. They are made up of a mixture of orthose feldspars and plagioclase bordering on albite. A few grains of quartz appear at the same time as large crystals of amphibole and muscovite. Towards the discharge of the lake, the intrusions of diabase appear which are met with as far as the outlet of Lake Simon. A blast was fired at the end of a point about one mile to the N. E. of the discharge of Lake David in one of these chloritic diabases traversed by veins of 1″ to 5 thick with filling of quartzite and chlorite. A few veins of very wrinkled quartz containing specks of iron pyrites run through the mass.

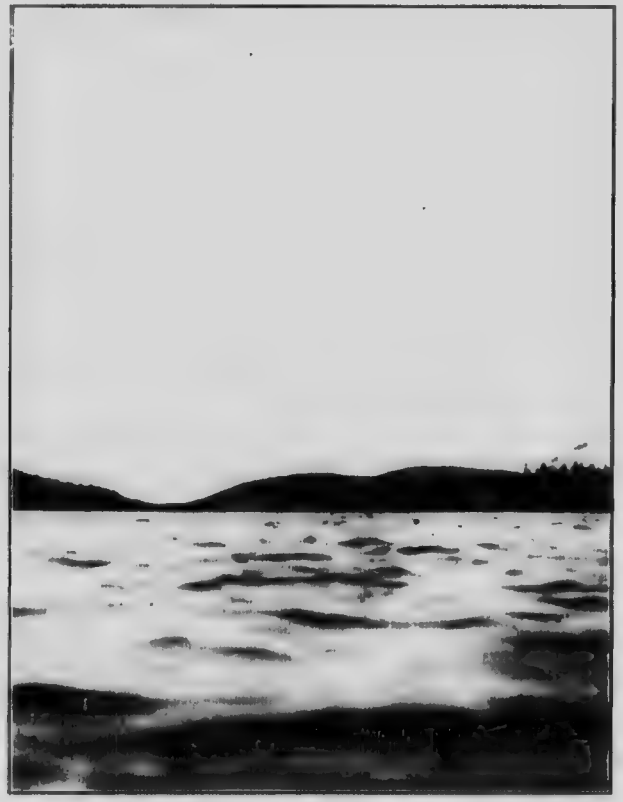
Between lakes Simon and David, the rocks are alternately diabase or coarse gabbros with veins in some spots of a light rose colored rock made up of quartz and orthose feldspar. The diabase is often schistous and holds sulphurets sometimes in the shape of impregnations and sometimes in small quartz veins without continuity. Gold has been found in one of these veins about lot 7, range VI, township of Scott.

A specimen of the coarse-grained rock (olivine gabbro) has shown large irregular crystals of amphibole and calcosodic feldspar injected with secondary transformation magnesian and calcic products (epidote-zoisite). Some grains of olivine appear.

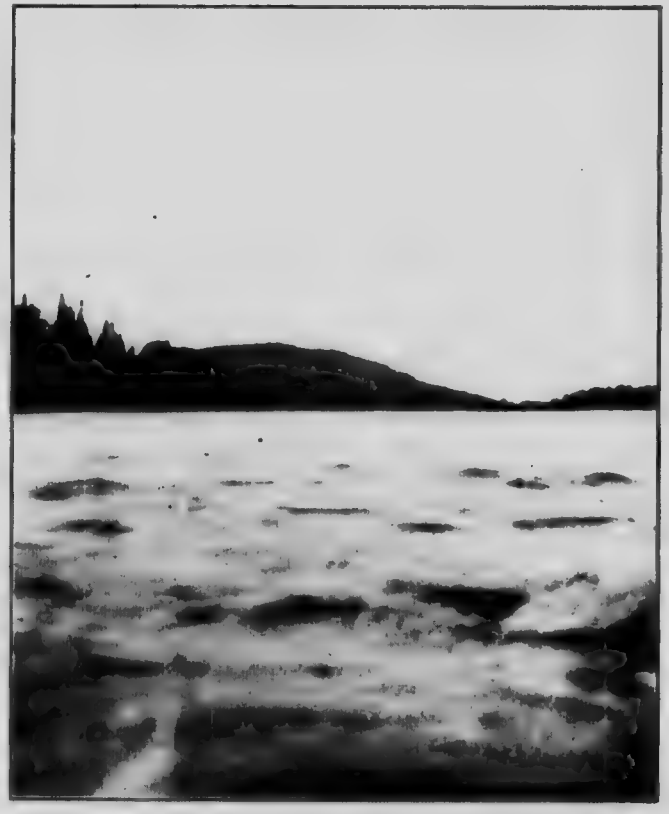
A specimen of greenish gray diabase of fine grain and conchoidal fracture shows a fine mosaic of quartz, decomposed feldspar and magnesian elements with chlorite and epidote predominating. This perhaps should be regarded as an ancient silicious rock of sedimentary origin embedded in the eruptive magma of the gabbros metamorphized, and injected with magnesian elements.

On the banks of the most southerly bay of Lake Simon, the granites re-appear very quartzous with chlorite as the chief constituent of the colored elements.

Lake Asinitchibastat.—The river Chibougamau enters into Lake Assinitchibastat between banks formed of chloritic granite, which soon yields to



Lake Bourbeau, looking South-West



Lake Bourbeau, looking South

series of basic rocks that follow each other along the whole length of Lake Asinitchibastat and the river Chibougamau. In but few places have these rocks retained their primitive condition. They actually appear either metamorphized by later eruptive outbreaks or transformed by the slow alteration of the elements. Thus, at the contact with the granite, schists may be seen injected with feldspars clearly showing that the metamorphosing granite of the southern part of Lake Asinitchibastat is posterior to the Lower Huronian formation with which the schistous diabase is associated. It is doubtless also to this granitic intrusion that must be attached the appearance of the quartziferous porphyry which outcrops at about 10 miles to the north of the granite in this diabase on the right shore of Lake Asinitchibastat (river Chibougamau) almost at the head of lot 6, range V, township of McKenzie. A specimen of this rock analyzed with the microscope shows in a very fine compact cement of quartz and a little feldspar, large crystals of quartz and feldspar, some of which have been partially transformed into epidote. Opaque elements, also visible, are iron pyrites.

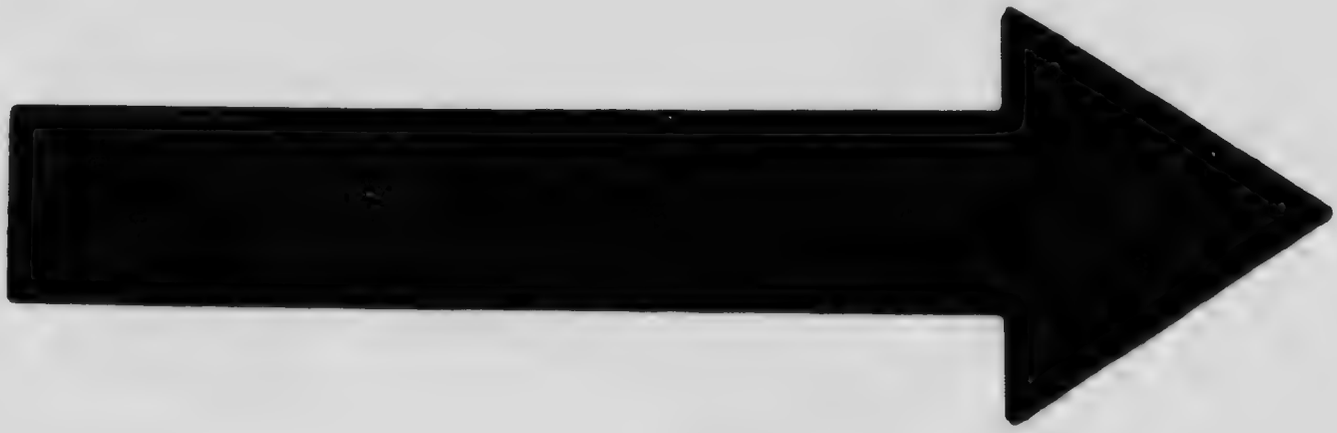
The green rocks, which make up the greater part of the banks of the river Chibougamau on leaving its confluence with Lake Asinitchibastat vary much in structure from one point to another.

At lots 10 IX McKenzie, 10 V Devlin and 13 VII Devlin, the diabase changes into a talcose and serpentinous schist. On lot 8 VI McKenzie, a large mass of impure serpentine was followed for 600 feet along the right bank of the river. It disappears to the south under swampy land. In the fissures of this serpentine a soft piroclite is pretty often encountered, but silky asbestos appears only rarely and in small cracks without continuity. In ascending a series of heights with a trend S. W. N. E., rising behind this belt of serpentine, I found that the serpentine in a less distance than half a mile changed into saussurite gabbros. Three specimens of these rocks were analyzed with the microscope:

(a) Serpentinous rocks: Showing cells of serpentine traversed by filaments of magnetite and surrounded by thin bands of talc.

(b and c) Gabbros. The rock of average sized grain shows orthoclase and plagioclase feldspar, saussuritized plagioclase, large crystals of orthorombic pyroxene (bronzite) and of monoclinic pyroxene. The amphibole is less frequent. One of these specimens also showed masses of zoisite.

It would seems from these examples that the serpentine corresponds to a more basic outbreak than the one which gave rise to this mass of gabbro This basic outbreak, composed solely of magnesian and ferruginous elements, gave birth to crystals of peridote (olivine) and of magnetite. The olivine, less stable, became hydrated into serpentine and talc, giving up its excess of iron



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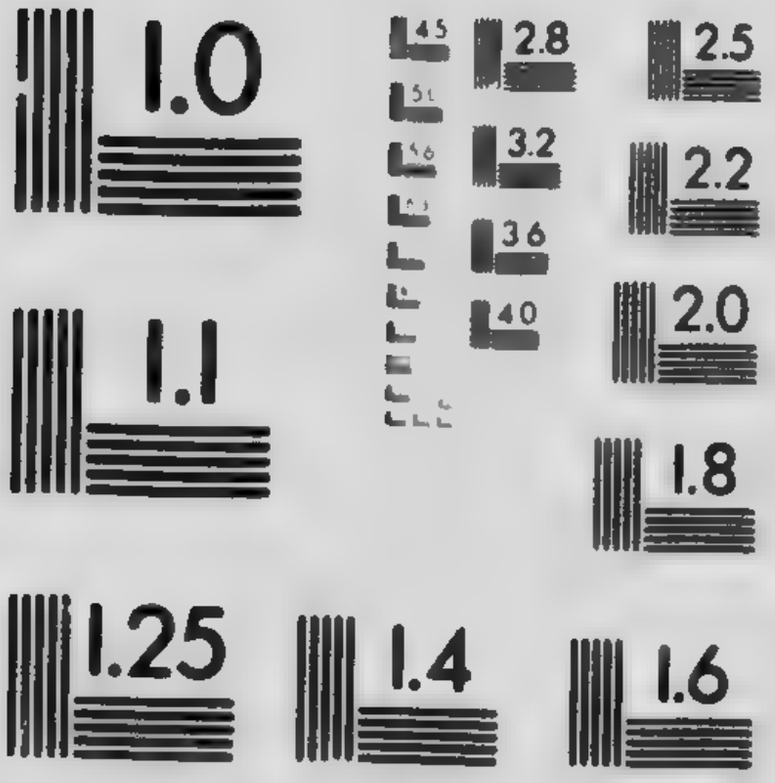

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which would have occasioned the isolated crystals of the pre-existing magnetite and would have connected them with filaments. The gabbros seem to have undergone another transformation with displacement of the lime of the feldspars and production of saussurite and zoisite.

On the level of river des Coucous (lot 9, rang VIII of McKenzie), two prospects have been made, one (on the left bank) in a rock containing amphibole and peridote embedded in a mosaic of saussurite feldspars; and the other in a schistous diabase rich in talcose products.

In all these rocks, veins of quartz and calcite are met with, but none of them are of large size. The calcite veins especially have no continuity and appear in the form of elongated lenses. Many of the quartz veins are accompanied by siderite, especially on lot 6, range II and 11 range VII of Devlin. It is to the decomposition of this siderite into oxyde of iron brought on by the water in the adjoining schists that is due the rusty coloring of certain rocks. The metallic sulphurets are not in abundance, speaking generally, and thus far no prospect has brought to light any interesting metalliferous deposit. Nowhere did I find erythrite (cobalt bloom) whose presence had been said to have been noted in the rocks of Lake Asinitchibastat.

III. PROSPECTING WORKS

Under present conditions connected with discoveries, the only minerals that can play an economic rôle are gold, copper, iron and asbestos. The two former are found in such close relation that they cannot be studied separately. We shall therefore examine successively :

I. The deposits of copper-bearing and gold-bearing sulphurets ;

II. The deposits of magnetic iron ;

III. The deposits of asbestos.

I. Deposits of Copper-Bearing and Gold-bearing Sulphurets

These occur in two forms :

1. *Deposits caused by segregation and impregnation*, such as the masses of diabases or gabbros in sheets, impregnated with sulphuretted elements (shores of Lake Doré, Portage Island).

2. *Fissure Veins.*—Such as the veins of pyritic gold-bearing quartz on Portage Islands, certain islands in lakes Doré and Bourbeau and in the narrows of Lake Simon.

I. Deposits iof impregnation and segregation

Portage Island. On this island Mr. McKenzie, during his first journey in 1903, made the first discovery of copper ores at the end of a point now called Copper Point.

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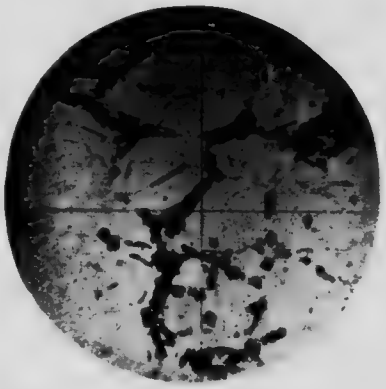

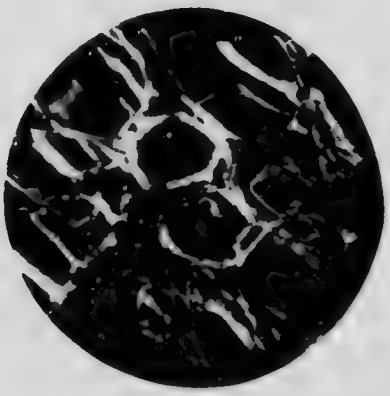

Right bank of Chibougamau river, lot 9, range VI, lot 9, range VII, McKenzie. Serpentine mass on heights commanding Beaver river.

In the natural light, the winding black lines are formed of remote grains of magnetite around cells of colourless serpentine constituting the grey background of the plate.

In a polarized light, with crossed nicols, the serpentine cells appear in wide, greyish black spots; the white strips around them are talc. The magnetite stands out in very dark black. At *a* there is zoizite.

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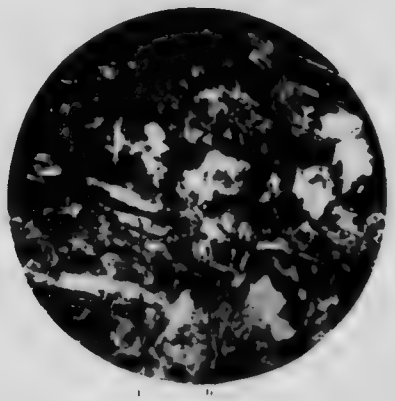
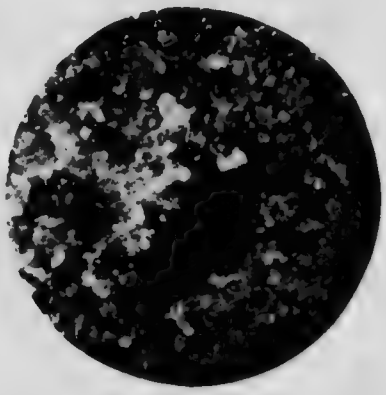


Right bank of Chibougamau river (lot 8 range VI, McKenzie.)
Serpentine along the beach.

In the natural light, thin black filaments of magnetite surround in the right part of the plate serpentine cells and dolomite crystals.

Between crossed nicols, the white parts are dolomite crystals; the black parts are serpentine; the strips, as at *a* are talc. The cell *b* is formed of dolomite crystals and amorphous serpentine.



Pyroxenic and garnet bearing instrusion, in central part of Asbestos Island.

In the natural light the wide, cracked whitish grey spots are garnets. The dark grey mass consists of crystals of pyroxene and olivine.

In a polarized light between crossed nicols the garnet's appear black; the crystals of pyroxene and olivine vary from white to black according to their orientation.

At present not only is the island covered with prospects but a small mining camp has been established there with dwellings, stores and laboratory. That camp is on the south-east shore of the island between Bourbeau point and North-East point. The mining rights on this island are owned by the Chibougamau Gold and Asbestos Mining Co., which has acquired the concession. That company keeps a small gang of men at its camp to develop its properties both on Portage Island and in McKenzie bay. On the island itself the heaviest work has been done on the large vein of gold-bearing quartz. We will describe it while studying the fissure veins.

At Copper Point, which lies about three quarters of a mile N.E. from the camp, two excavations have been made quite near the shore in a diabase which changes very soon, running north, into a conglomerate, the cement of which is of the same nature as the diabase aforesaid. The dimensions of these excavations, which are of irregular lens shape, are 25 feet by 5 feet for the larger and 15 by 5 for the smaller. This depth is from 3′ to 4′. They are about 100 feet from one another.

The metallic elements are scattered through the diabase itself in the following order as regards importance: pyrothite, iron pyrites, copper pyrites. These sulphurets are accompanied by carbonates (siderite, dolomite and calcite). The gozan shows some specimens of carbonate of copper and the surface schists are strongly tinged with green. There is no compact mass or vein, but the metallic elements are scattered irregularly through the rock in veinlets, stains and pockets. In some places the sulphurets are massive but none of the masses exceed one foot in diameter. It may be said that the whole rock itself is mineralized. The proportion of sulphurets and metallic carbonates exceeds 50 p.c. By hand picking the mass itself, which could easily be done, ore containing 60 to 70 p. c. of sulphurets could be shipped. Before all, some prospecting would have to be done on the surface to ascertain the importance of the deposit. I did not do any precise sampling of the mine, but, to get an idea of the average value of the ore that might be obtained from the excavations already made, I got two persons who accompanied me, to pick out at hap-hazard some forty samples of about half a pound in each excavation, while I did the same myself at the same time, taking as far as possible what seemed to me to represent the average percentage. These samples were sent to the laboratory, crushed, mixed and quartered down to a weight of 2 pounds. These samples were taken down to Montreal and analyzed. The result was as follows :

Large excavation :

Gold	$ 0.20
Silver	0.00
Copper	1.35 p. c.

Small excavation:

Gold	$ 0.96
Silver	0.20
Copper	1.33 p. c.

Other specimens picked from among the finest gave the following results:

1. Calcite and carbonate of copper

Gold	$ 5.00
Silver	0.22
Copper	5.50 p. c.

2. Massive sulphurets

Gold	Heavy traces
Silver	$ 0.50
Copper	2.69 p. c.

The last results lead to the belief that there has been a concentration of gold in the superficial carbonated and oxydized portions.

Proceeding from Copper Point in a N. E. direction, the shores seem strongly mineralized both in sulphurets and in magnetic oxyde. The compass in the canoe was affected and showed variations of 90° from one point to another. At some points on the shore the broken rock showed sulphurets of iron in considerable quantities (50 p.c. at least of the weight).

At Calcite Bay, an altered diabase of a somewhat serpentine nature, shows a vein of calcite 3 feet thick accompanied by a parallel vein of quartz 1 foot thick. A few blasts were fired but showed nothing. The calcite is white, pure, without sulphurets or colors of carbonates of copper. The walls in contact with the quartz alone contain some sulphurets. A descending fault cuts the calcite vein whose outcropping disappears in the east.

At Hematite Point, work done in the summer of 1908, exposed:

1. A vein of iron pyrite and of hematite, the whole mixed with grainy quartz in a schistous diabase, itself impregnated with crystals of iron pyrites. The vein is level with the water and disappears under under a layer of earth and can be followed only for 6 feet ;

2. Thirty feet to the west of the former a vein 1 foot wide, consisting solely of compact iron pyrite. The walls consist of very rusty quartz.

The assay for precious metals gave only traces. I mention these veins on

account of the association of hematite and iron pyrite which is all the more curious because oxyde of iron is found only in the form of magnetite in the neighboring rocks. This would indicate a reducing action of the sulphurous vapors transforming $Fe_3 O_4$ into $Fe_2 O_3$ at the time of the metalliferous production which was doubtless contemporaneous with that of the gabbros.

Iron Pyrites of Paint Mountain.—Parallel to the S. E. shore of Portage Island rises a chain of hills, the highest of which is called Paint Mountain, which contain iron pyrites sometimes in grains, sometimes in irregular masses, sometmes in veins probably interfoliated in the schists. None of those masses or veins attain great dimensions. Some blast were fired in various places, in particular at a quarter of a mile north of the large gold-bearing quartz vein in a massive diabase containing 50 p.c. of sulphurets disseminated in grains. Three quarters of a mile to the S. W. of the camp, a cutting was made in the chloritous schists containing sulphuret of iron In some spots the schists are replaced by massive pyrite which seems interstratified in the layers of the schists. The dirction of those layers is N. N. E. and the dip. 70°. The rusty soil was washed in the pan and showed some slight colors of gold. The assay of those massive sulphurets for gold, showed only traces.

Thus, it may be seen that the earths of Portage Island, in their entirety, have been very considerably mineralized by a production of metallic sulphurets which injected the pre-existing rocks. These sulphurets, which are generally iron pyrites, would be of no interest were it not that, at certain points (Copper Point) the gold they carry with them and the copper of the chalcopyrites give them some value. With regard to Copper Point, considering the comparatively slight yield in copper and in precious metals given me by the assays, it is necessary above all to develop the surface prospecting to ascertain whether the quantities there are sufficient to allow of the ore being treated to advantage.

Prospect on the line between the townships of Roy and McKenzie—North West Shore of the Lake Doré.—About a quarter of a mile from Lake Doré is a small excavation from 4 to 5 feet in diameter and 1 or 2 feet deep, in a diabase injected with white iron pyrites. Some fissures are filled with massive grained iron pyrite whose thickness varies from some tenths of an inch to one and two inches. The assay of samples taken at hap-hazard gave me

Gold...	Traces
Silver	$0.15

Prospects south of the line between the townships of McKenzie and Obalski.—The sketch No 1 was made only to indicate the location of the prospects of which we are about to speak.

At the points a, b, c, three excavations were made along the shore ; the distances between them are respectively 10 and 200 feet. The dimensions are:

Excavations :

a	7′ long,	4′ wide,	6′ deep
b	7′ "	5′ "	12′ "
c	7′ "	5′ "	6′ "

These excavations were full of water when I passed there : there were 8 feet of water in excavation b and 4 in the others.

The rock is a gabbro injected with quartz running in parallel veins which gives it the appearance of gneiss. It contains intrusions of talcous schists, due to the tearing up a dragging of the surrounding soil at the time of the eruption of the gabbros. The whole is traversed by veins of quartz, calcite and a little siderite. Some iron pyrite, chalcopyrite and pyrothite are injected in the schists and in the gabbro while the quartz contains numerous splashes of sulphurets.

The stuff taken out from excavation b shows 4 or 5 tons of a good copper ore, the percentage of which I estimate to be between 5 and 10 p. c. It is true that these pieces have been sorted by hand. Some massive blocks of collected pyrite containing a little copper, have a diameter of one to two feet.

The assay of some samples at hap-hazard among the stuff taken out of the excavations and already sorted by hand, gave :

Gold..	$2.80
Silver..	1.15
Copper..	5.46 p. c.

The excavation c shows no massive intrusions of sulphurets in the rocks, but merely of disseminated grains. It appears less rich than excavations a and b.

These excavations are quite near the shore in the rock; as one leaves the shore the rock becomes covered with boulder clay.

At the point d on the shore of a small lake (Lake Caché) communicating with Lake Doré by a discharge with a slight current, a series of slight excavations have been made in the gabbro. These adjoin one another and do not extend more than 300 feet. The most interesting of them has met an intrusion of talcous schists about 5 feet wide dipping vertically and the schistosity of which runs N. N. W. The excavation is rectangular, 5 by 5 feet with a depth of 9 feet. There were 5 feet of water in it at the time of my visit. The walls show a schist impregnated with pyrites of iron and copper, which, after the work was abandoned, had been transformed into oxyde of iron and carbonate of copper. Samples taken from what seemed the most mineralized gave :

Work No. VII on quartz vein of Portage Island

Gold....	traces
Silver..	$0.20

Other excavations come upon similar schists, with quartz veinlets parallel to the schistosity.

South East Shore of Lake Doré.—About a mile and a half from the main discharge of Lake Chibougamau, begins a series of works following the S. E. shore of Lake Doré and which were done under the direction of Capt. Machin. There is also a mining camp on the small discharge. It was uninhabited when I passed there.

The works consist in a series of small excavations along the shore. The rocks are alternately talco-schists injected with pyrites and mostly rusty on the surface; magnesian rocks (probably old gabbros) impregnated with quartz in parallel veins. Many of these latter rocks are striped like gneiss, due to the disposal in parallel bands of variously colored elements (quartz, calcite, dolomite, siderite, sulphurets). This denotes the metamorphising action of an eruption accompanied by sulphuretted metallic vapors. Between the layers and the fissures of the pre-existing, broken, crumpled and even dragged rocks, the metalliferous elements have been deposited, while, at the same time, a segregation in parallel zones has been produced in the eruptive magma.

In A, veins of quartz, dipping vertically, appear; they have a common N. S. direction and are broken by small faults, all running S. W. The surrounding schists are greatly crumpled. The quartz contains sulphurets as well as the schists.

At B, an excavation has been made in a zoned magnesian rock containing, with parallel veins of siderites nodules of pyrites of iron slightly cuprous. Some of these pyrites are surrounded by siderite which would thus appear as a product of secondary transformation of pyrite by the circulation of carbonated waters. A concentration of sulphuret of copper at the centre seems to have been produced as in the process of roasting in nodules followed in copper metallurgy.

An analysis of picked samples from the most impregnated rocks, ga e:

Gold..	$ 2.60
Silver..	traces
Copper..	3.37 p. c.

At C is a rectangular excavation, 4 by 6 feet, and 4 feet deep, in talcous and somewhat serpentinous schists. On the southern face it shows a vein of pyrites of iron and copper 5 inches thick which ramifies through schists strongly impregnated with carbonates of copper.

The direction of this vein is S. S. E. and its dip 80°. The schists of the other faces of the excavation are also impregnated with sulphurets. Some veins of aragonite, cutting the schistosity, appear here and there.

Samples were taken at the same time in the vein of pyrites and in the carbonated schistous portions. They gave:

Gold..	$ 3.60
Silver..	0.25
Copper..	7.35 p. c.

At E an excavation, 5 feet by 7, with a depth of 11 feet, cuts gabbros of a zoned structure, containing sulphurets of iron and copper with large quantities of siderite. These metallic elements appear, as at Copper Point and Portage Island, in the shape of splashes and irregular masses segregated in the rock. Nevertheless there is more siderite here than at Copper Point. Samples were taken on the dump. After being broken, the carbonated and sulphuretted parts were carefully sorted in the laboratory of the Polytechnic School. An assay for gold and silver was made of the two separate lots and the result was :

Sulphurets:

Gold...	$4.00
Silver.	0.15

Carbonates :

Gold	traces
Silver	traces

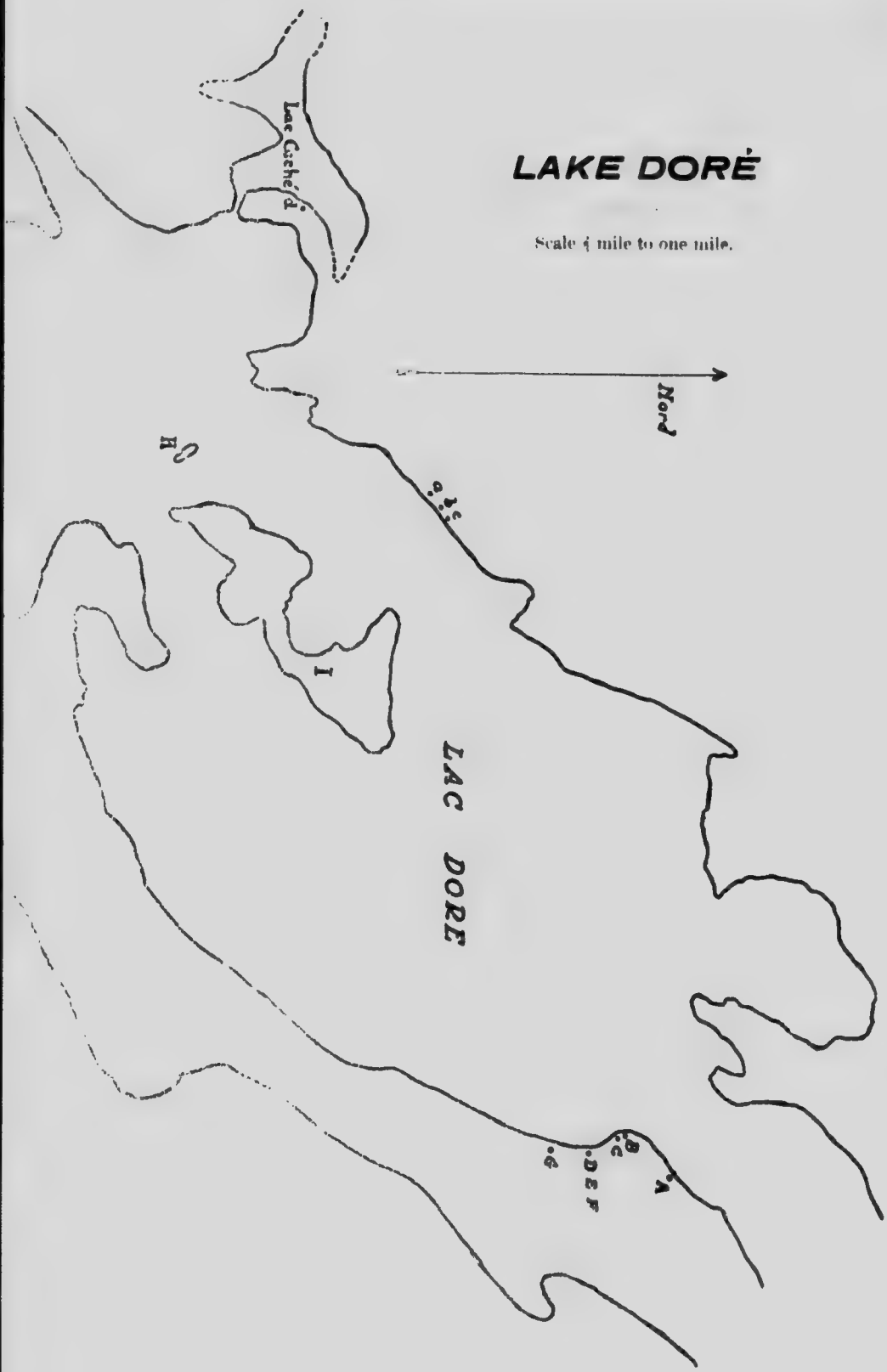
The poverty of the carbonates in gold seems a proof in support of the theory that a concentration of copper and precious metals must have taken place in the sulphurets if it be admitted that the carbonates are a product of secondary transformation.

The oxydized parts of the surface contain almost nothing but ferruginous products. There are a few blue or green colors of copper.

D, F, G, show where some superficial blasting was done. They all showed that the rock (sometimes coarse grained, a real gabbro, sometimes diabase of a foliated structure) was everywhere mineralized in the same manner. A few blows with a pick-axe, which I struck along the road on the shore between these varied prospects, showed me again the presence of sulphuret of iron and of copper and of siderite. The extent of the mineralization spreading uniformly over the 600 or 700 feet examined, leads to the belief that these low grade but widely distributed ores could be profitably worked. It should however be observed that the assays were made of some choice samples and cannot give an average by any means.

LAKE DORÉ

Scale ¼ mile to one mile.



II. FISSURE VEINS

The best known, the best developed deposit and the only one in the region whose value can be estimated is that consisting in the veins of gold-bearing quartz of Portage Island.

Quartz veins of Portage Island.—The annexed map is a rapid sketch showing the condition of the work in August 1908. Having no other instruments, I took the angles with the compass; some allowance must be made regarding the accuracy of such a sketch owing to the variations in the declinations caused in those regions by the continual presence of magnetite in the rocks.

The deposit is in the shape of a series of veins of quartz interstratified in a schistous diabase. The main cluster runs nearly E. W. A secondary and less regular cluster detaches itself from the first in a N. E. direction. The first cluster constitutes the large vein and the second the small vein. The prospecting work on the large vein comprises 9 cuttings running nearly N. S. the largest of which is 102 feet and a shaft 45 feet deep. On the small vein 3 cuttings have been made, the longest being 50 feet. These cuttings are numbered on the plan in roman numerals for the large vein and in arabic numerals for the small one.

Cutting No I, 87 feet long, was full of boulder clay that had slipped from the sides. Quartzous outcroppings seem to have been found. I could not verify this otherwise than by the quartz debris mixed with the lumps of clay.

Cutting No II, showed 7 feet of earth fallen in, 2 feet of quartz, 6 feet of schists and 10 feet of quartz.

Cutting No III, 54 feet long; the sides had fallen in and none of the rock *in situ* could be seen.

Cutting No IV, 34 feet long, showed from North to South, 6 feet of quartz, 6 feet of schists, 22 feet of quartz.

It stopped abruptly on the south. It is probable that, if extended, outcroppings of quartz would be found.

Cutting No V.—This was the longest (102 feet) and in the best condition. It cuts a sort of concentration of the cluster of quartz veins which, over a length of 51½ feet from the northern extremity, showed only two intrusions of schists of 6 and 8 feet.

Thus, from North to South are found:

quartz 12 feet
schists 6 "
quartz 3 "
schists 8 "
quartz 22.50 feet.

Within the 10 following feet, the schists outcrop and disappear under a layer of boulder clay which it would have been interesting to remove to seek lower down for a remoter vein of that cluster.

As in the other cuttings II and III, the quartz is charged with sulphurets, but on the level of cutting No V, there is a very clear enrichment in metallic elements. Thus, between the 2 schistous intrusions of 6 and 8 feet and south of the latter, compact masses of pyrites of iron and chalcopyrites attain dimensions of 4 and 5 inches. The schistous intrusions themselves are full of cubic crystals of iron pyrites when not entirely rusted to such an extent that in contact with quartz they form real gangues of limonite.

The dip of these veins seems to be 70° towards the south. In any case this is the dip of the planes dividing the quartz veins from the schistous intrusions. It should, however, be observed that in the northern part of the cutting one can clearly see a spur of a quartz vein dipping 45° to the north, that is to say in a direction almost normal to the previous one. This occurs still more clearly in cutting No VII where the quartz veins and the layers of schistous diabase form 2 series crossed at right angles and which, in consequence of erosion, form a series of steps under the boulder clay. It would thus seem that this large vein of quartz is not the filling in of a real fissure with defined walls, but the filling in between layers and fissure of a diabase rendered schistous by pressure. It is in fact well known that a constant property of schists is to square according to 2 directions of planes of unequal ility; one corresponding to the schistosity and the other, perpendicular to it, is shown by large fissures through the rock.

Samples were taken along this cutting as follows: 51½ feet from the northern extremity 3 samples of about half a pound each were taken at nearly every 2 feet: one at the bottom of the cutting and the two others from the walls. These samples were crushed in the camp laboratory and quartered down so as to have a sample of about 2 pounds.

This sample was analyzed in Montreal and gave:

Gold.....	$2.00
Silver..	traces
Copper ...	1.28 p.c.

PLAN OF THE WORKS

On the vein of quartz of Portage Island

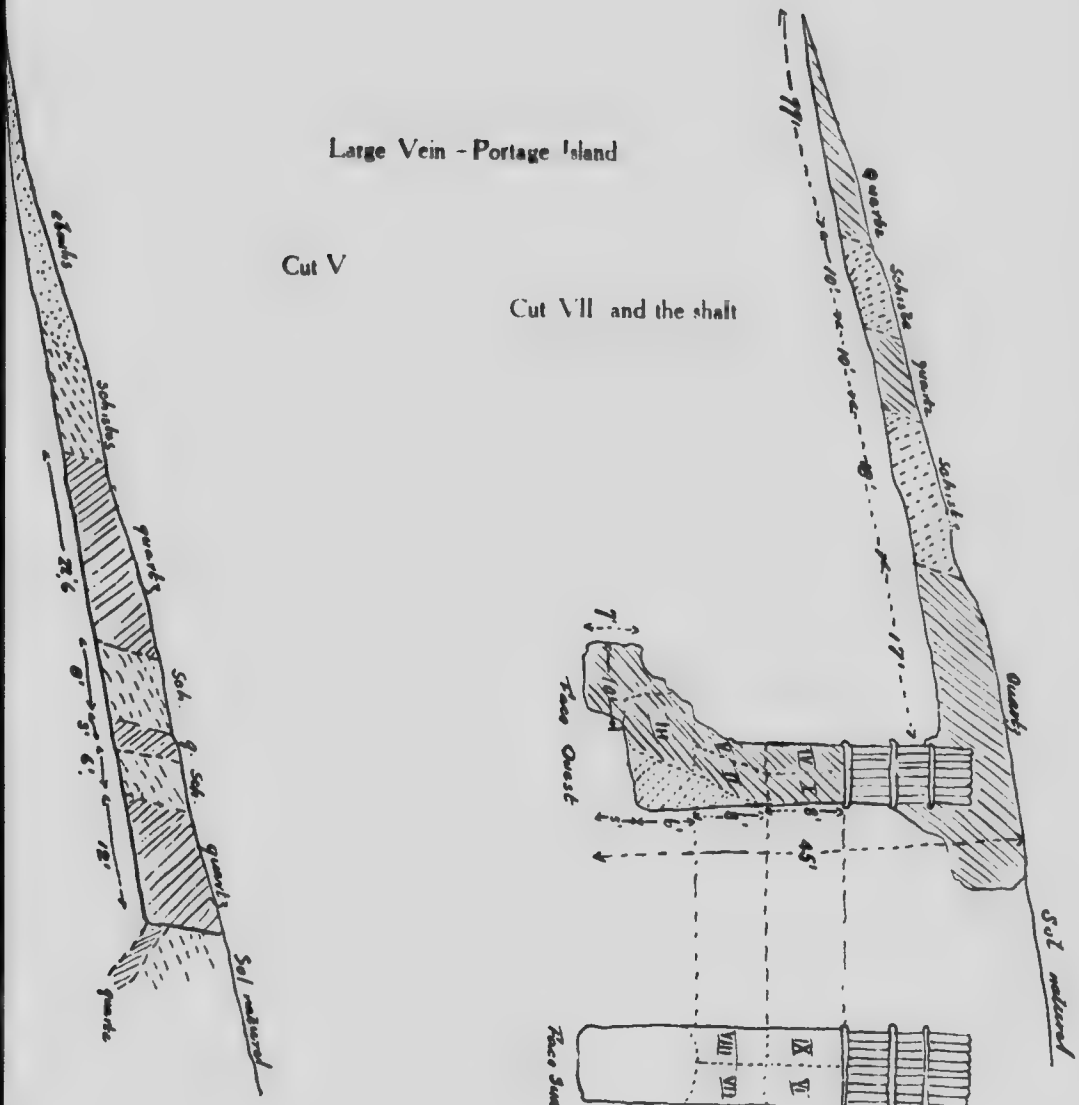
Scale : 100 ft. to the inch.

Heavy parts on the cuts indicate out-cropping quartz

Large Vein - Portage Island

Cut V

Cut VII and the shaft



Cutting No VI, 24 feet long, was filled with the earth that had fallen in.

Cutting No VII., 97 feet long. A shaft was sunk at its northern extremity and at that level the cluster presents the greatest thickness. In fact from north to south we have

35	feet of	quartz
18	"	schist
10	"	quartz
10	"	barren rock
17	"	quartz

giving for the whole of the cluster observed a thickness of 90 feet, containing 62 feet of compact quartz.

Considering the irregular appearance of the schistous intrusions one can in nowise conclude that this distribution of quartz and of barren rock continues with the same depth : it may as well be imagined that the schistous intrusions wedge themselves between quartz veins closing on one another, as the contrary, which would have a quartz vein thinning down between two layers of rock.

The shaft is rectangular with a section of 6 by 8 feet. Its total depth is 45 feet. It is timbered for 18 feet. It extends in a southerly direction under the cutting by a spur of a drift 12 feet deep, the bottom of which was full of water at the time of my visit.

The walls of the shaft show the irregularities of the quartz veins which are divided or reduced in depth by schistous intrusions not visible, while other veins of quartz appear. It is impossible at present to determine the wall of such a cluster.

In view of this constitution of the large vein, the quartz met with there is in general very fissured and the surface waters, in circulating between the schists and the quartz, have oxydized a great part of the metallic sulphurets and thereby produced a concentration of precious metals in the superficial portions of the deposit.

Specimens taken from the Shaft.—The west face of the shaft, starting from the wooden casing, was divided into 5 irregular quadrilaterals of about 3′ wide by 8′ high and numbered from I to V (see sketch). The south face above the drift opening was divided into 4 rectangles of 6′ wide by 8′ high, which were numbered from VI to IX. In each of these quadrilaterals, from all the square feet laid out with plum bob placed on the woodwork, a specimen of ⅜ to ½ of a lb. was taken. The 9 lots thus obtained gave the following assays :

I..	$ 0.15	0.00
II..	0.10	0.05
III..	0.15	0.00
IV..	0.15	0.00
V..	0.15	0.00
VI..	0.40	0.19
VII..	2.00	0.10
VIII..	0.15	0.05
IX..	0.00	0.00

A sampling was made of cutting VII in a similar way to that of cutting V, and the results obtained were as follows:

Gold..	$ 0.80
Silver..	0.60
Copper..	2.68 p. c.

Oxydized debris taken from the crevices in the quartz and the rusty parts of the quartz itself at the northern end of cutting VII yielded:

Gold..	$12.77
Silver..	0.40

Lastly, pieces selected from the same northern end in the parts rich in sulphurets, showed:

Gold..	$ 4.00
Silver..	Traces.

Cutting VII: This cutting in reality comprises 3 cuttings of 78, 40 and 30 feet. A layer of boulder clay derived from the caving in of the sides covers the bottom, rendering it impossible to follow the outcroppings of the rock. However at the southern extremity of the cutting of 78′,large masses of quartz form a projection for a length of 12′. These masses seem to dip in two rectangular directions, as I have already explained. They are greatly rusted . A specimen taken from the surface yielded only a trace of the precious metals.

Cutting IX: A short cutting of 12′ shows two veins of quartz 1′ and ½ thick, separated by a bed of 1′ of schistous diabase. The direction is S. W. N. E. and the dip 24° N. If it be remarked, however ,that the wall rocks appear broken according to a plan normal to the foregoing dip, it will be seen that here agin appear these two rectangular strikes of schistosity and of easy fracture according to which the quartzose fillings took place.

In fine, it may be said: (1) that the group of quartzose veins constituting

the big lode has been traced for 725 feet from cutting II to cutting IX (for 900 feet if it be admitted that cutting I had re-crossed the group).

(2) That this group, in its central part, presents, on the level of cuttings V and VIII, an expansion of veins projected into a schistous rock impregnated with pyrites, in such fashion that its maximum breadth following the slope reaches 90′.

(3) That the widening of the group coincides with an enrichment in sulphurets (sulphurets of copper especially) and in gold.

(4) The enrichment in precious metals is due not only to the greater abundance of sulphurets, but also to the nature of the ground and the quartz veins, which, very crumpled and fractured, have permitted an oxydization of the sulphurets and the removal of the soluble metallic elements, (iron, copper), together with a local concentration of the gold, much of which is in the free milling state in the superficial portions of the deposit.

Small vein.—This forms a group which breaks off from the former in a S. N. W. E. direction and which has been [illegible]ved by 3 cuttings.

Cutting No 1 is 30′ long and 4′ deep at its head. It is towards the head moreover that the quartz veins are concentrated, which more than in the large group, are extremely irregular. Thus in the first 9 feet going down from the surface of the soil the walls of the cutting show a square of 8′ by 8′ containing with the schists, numerous veins of quartz, the largest of which shows an outcrop 3′ wide by 6″ thick, while immediately underneath and alongside, the schists reappear without any quartz vein, showing clearly that these veins do not coincide with a continuous fracture of the land, but are due to the filling of the local fissures.

These quartz veins, moreover, are especially rich in sulphuret of copper. At the contact with the schists, the quartz is rusted and holds small quantities of malachite and azurite.

Two series of specimens were taken: (a) from the quartz veins pieces were taken among the most heavily mineralized and yielded

Gold	$ 3.00
Silver	0.38

(b) Specimens from the rusted parts gave

Gold	$12.80
Silver	0.15

Which shows the concentration of the precious metals in the rusted parts. On the other hand it is certain that the results obtained from these picked specimens may be taken as representing an average of the percentage.

Cutting 2 reveals a small quartzous outcropping 2 feet wide which at a depth of 3 feet wedges into the schists. This quartz is rusted and shows carbonates of copper although in smaller quantity than in cutting No 1. The gangues are formed of a very friable ochreous oxyde of iron.

Cutting 3, 80′ long shows at its head a quartz disseminated in rotten schistous diabase with stains of rust on the surface and which as it goes down passes into a rock charged with magnetite.

Quartz Vein at Lake Bourbeau.—At the point marked **a** on the sketch of Lake Bourbeau, south shore, there is a vein of quartz that was discovered in the spring of 1908. The only work done upon it consists of a superficial excavation occasioned by the firing of an unburied charge of Rocaroc. It has brought to light an outcrop of compact white and blue quartz holding iron pyrites and small specks of mispickel. The width in the vein laid bare is 4′ : the real width must be greater as I could only find one wall dipping vertically. The other was hidden beneath a heavy coating of soil. The probable trend of the vein is W. N. W. The encasing rock is a diabase rich in carbonate and itself impregnated with iron pyrites.

In seeking for the prolongation of this vein in a W. direction, I found quartz outcrops in the same chloritic schists at 40′ and at 500 yards from the first excavation. At the latter point there is a vein of compact blue and white quartz with a marked W. direction and dip 60° North.

Assays made of the specimens taken at the first outcropping gave:

(1) Compact quartz:

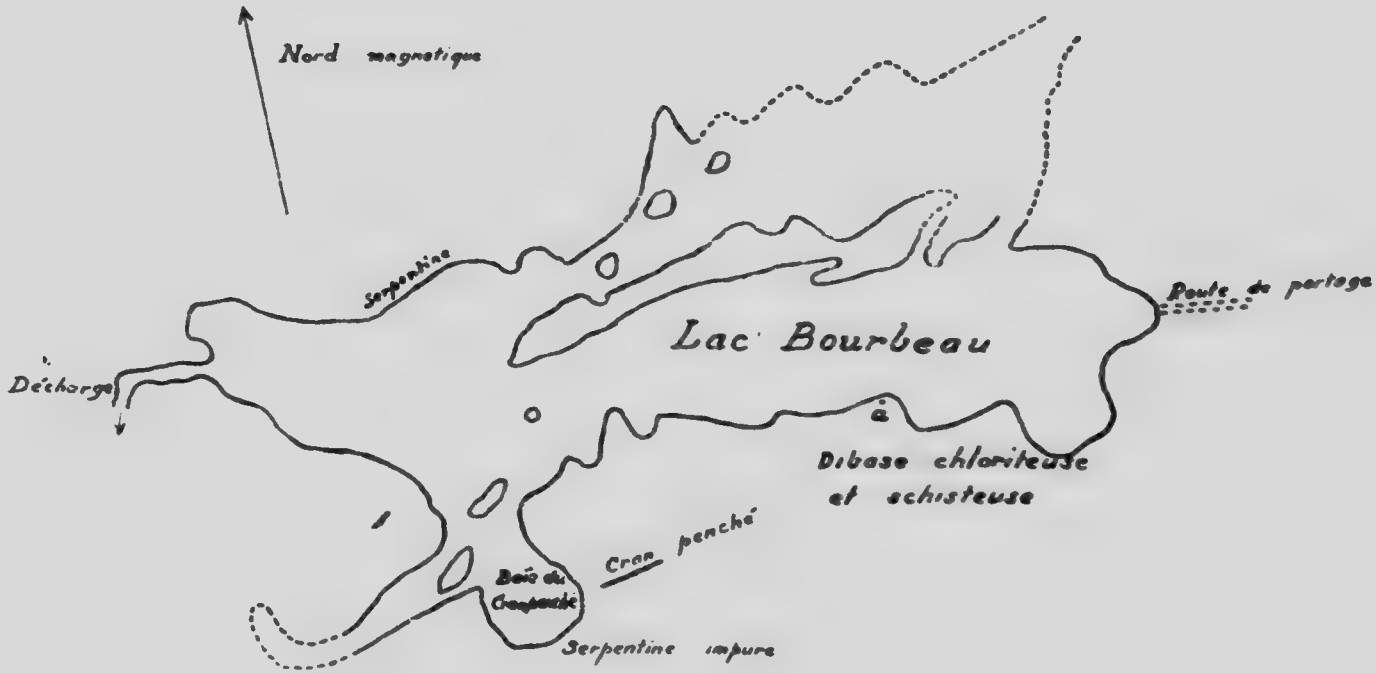
Gold..	$ 0.80
Silver..	0.25

(2) Rusty walls:

Gold..	$ 1.80
Silver..	0.15

Quartz Vein on Island I of Lake Doré.—Work, also done in the spring of 1908, showed the existence on the island (the largest in Lake Doré) of a quartz vein which appears to be the largest vein discovered in the region. The work, altogether on the surface, has only laid bare the natural outcrops of a massive white quartz without marked schistous intrusions. If it be admitted that the outcrops thus cleared all belong to the same vein of quartz, this vein has been followed for a length of 310′ and a width of 75′.

The encasing rock is a decomposed pyritous gabbro.


Nord magnétique
Serpentine
Lac Bourbeau
Route de partage
Décharge
Dibase chloriteuse
et schisteuse
Cran penché
Baie du
Serpentine impure

The quartz itself is poor in sulphurets and presents no rusty surfaces, while its great compactness is a bad indication of its percentage of the precious metals. An assay moreover of this quartz only yielded traces of gold and silver. It would be interesting to ascertain if other parallel veins would not be richer in sulphurets.

Quartz Vein on Island II of Lake Doré.—A small island at the head of Lake Caché bay and not more than 120′ long and 70′ wide at low water shows in the southern part a 10′ by 45′ outcrop of quartz. The whole forms an irregular cluster of small quartz veins without determined dip, running in a general direction E. S. E. and dovetailed into the talc schists. At its W. S. W. extremity, the cluster scatters in veinlets through the rock. The rock itself in the neighborhood of these veins is a mosaic of magnesian and ferrous el ments (chlorite, talc, decomposed pyroxenes) and specks of iron pyrites slightly cupriferous.

Specimens taken from the W. extremity gave a heavy percentage of precious metals:

Gold..	$14.40
Silver..	0.20

Vein of Quartz and Siderite between Lakes Simon and David.—This quartz vein, which we noted on our way to Lake Asinitchibastat deserves mention, because the assay made on the specimens taken from it yielded a percentage of $5.00 in gold to the ton. It occurs on the left bank of the short stream connecting Lakes David and Simon at the level of the narrows preceding the first widening of Lake Simon nearly in range VI, lot 7, of the township of Scott. No prospecting work has been done yet and I think it would be important to make some searches at this point The quartz shows for a length of 35′ and a width of 10′ on the surface of a rocky promontory, but in all probability this large outcropping only corresponds to a detaching of the rock in the plane of a quartz lode. At ½ a foot underneath there appears to be another small vein, parallel with the first. At 20′ S. of this outcrop and altogether level with the water, the beginning of a third vein of quartz is visible. The quartz in these veins is mixed with siderite almost entirely transformed into limonite at contact with the encasing rock. Blue clay taken from the level of the water or in contact with the quartz vein and washed with the pan showed a dozen colors. The specimens analyzed were taken one half from the quartz and the siderite and the other half from the encasing rock. They were pretty rusty. The assay gave:

Gold..	$5.00
Silver	0.35

Prospecting on Lake Asinitchibastat at the level of the Rivière aux Cou-

cous. (VIII 9, Devlin).—(1) On the left bank a few blasts have been tried in a rock composed largely of chlorite and epidote, bringing to light a lens of hard white quartz with a maximum width of 8 inches, a N. E. direction, and a dip of 30° W. Small veins of calcite traverse both the quartz and the rocks and a few rare crystals of iron pyrites are scattered through the whole.

(2) On the right shore, opposite the foregoing, veins of quartz and calcite crop out without definite direction and encased in talco-schists.

In none of these prospects did I find ores in any commercial quantity.

Other veins of quartz and calcite are met with along the banks of lake Asinitchibastat. They are of small size, generally speaking, and none are mineralized to any interesting extent.

I looked in vain for erythrite (cobalt-bloom) whose presence was reported from the discharge of Lake Simon to about 1 mile beyond the dividing line between the townships of McKenzie and Blaiklock.

II MAGNETIC IRON DEPOSITS

These were first looked for around the magnetite cone, but it is now known that the rock composing the cone, is an impure serpentine, decomposed on the surface and holding only from 10 to 20 p. c., of oxyde of iron in the form of magnetite. Nowhere is the proportion of iron sufficient to work.

The attention of prospectors was next directed to the veins of compact magnetite met with in the mass of the Sorcerer and on the north shore of Baie des Iles. But in no place were these veins found to have a sufficient thickness and continuousness. They filled the shrinkage fissures which took place during the consolidation of the eruptive magma, rich in ferruginous elements. These elements have crystallized either in grains scattered through the mass or in veins of ever restricted dimensions. Some of these veins are actually transformed into limonite in the more decomposed rocks. These veins would possess no industrial interest, if in certain places the encasing rock itself did not contain a very important percentage of magnetite. Thus along the east shore of the bay on lot 8, range III, township of Roy, there is for 500′ a natural bluff produced by the detaching of the rock following a thin vein of magnetite. This bluff is crossed in all directions by small veins of pure magnetite, ranging from a small fraction of an inch to 4 inches in thickness and the rock itself contains a high percentage of iron. The analysis showed:

Silicon	15.23	
Al_2 O_3	1.09	Corresponding to 45.70 of Metallic Iron.
Fe_3 O_4	63.07	
Mg O	16.79	
Ti O_2	0.52	
	96.70	
Undetermined (Water and Alkalis)	3.30	
	100.00	

At this percentage, the rock itself is an iron ore. It would be important to prosecute the research work on the surface which would reveal to what extent this percentage continues. At the same time some borings might be made to ascertain the variation, if any, in depth.

It would be premature to say that we have iron mines there that could be usefully worked. Iron ores are so abundant in the world that, to render an ore workable, it must present certain very special conditions:

(1) The extent of the deposit must be all the larger when the deposit occurs in a region more distant from the industrial and especially the coal centres.

(2) The percentage in iron of the ore must be all the greater because on the one hand the deposits are more remote from the industrial centres and on the other the ore is harder to smelt in blast furnaces. This last consideration is very important, for if ores can be treated in the east of France and in Germany, whose percentage in iron varies from 25 to 40 p. c., it is because such ores are very fusible.

(3) The impurities, especially in sulphur, very promptly reduce the value of ores.

With respect to the titanium, small quantities of which accompany the magnetite in the ores of Chibougamau, its harmful influence has been much exaggerated. Titanium being very refractory is not reduced in the blast furnaces and passes into the slag. In large quantities, it renders this slag hard to fuse, hence its more difficult treatment in the blast furnace and a greater expenditure of fuel. From the industrial point of view, a titanic ore is simply a refractory ore. Titanic ores moreover are being actually treated. For instance, the pig iron of the Adirondacks obtained from ores holding at least 15 p. c., of titanic acid has only a proportion of 0.3 p. c. of titanium.

The magnetic rocks of Chibougamau hold a proportion of titanium and sulphur far below the injurious limit. It would be interesting to ascertain:

(a) If the proportion of iron remained sufficiently high over considerable extents of the rocks in the Baie des Iles.

(b) If these rocks are easily smelted in blast furnaces.

III. ASBESTOS

Asbestos Island.—This island situated in the western part of McKenzie bay, is composed chiefly of an impure serpentine, grainy and often containing a pretty large quantity of magnetite. Towards the centre of the island, a dyke of white rocks, which under the microscope are shown to be made up of feldspars, pyroxene and garnet, the latter very abundant, traverses the serpentine. The eastern end of the island is formed of black schists containing carbonaceous matter.

The prospecting work for asbestos comprises a series of cuttings, the more important of which are on the southern slope of the island. The first, starting from the west, has a length of 50′ and a face of 12′ in height. A flooring in squared timbers has been laid down along the bottom of the cutting. It conducts the material to a dump placed in the prolongation of the cutting.

The working face is composed of a grainy serpentine containing numerous veins of a light, hard, slightly fibrous (picrolite) serpentine unfit for any use. The few veins of silky asbestos met with do not exceed a thickness of ¼ inch. In the planes of fracture and probably also of faulting of the rock, a long fibre asbestos is noted, but the fibres of which lengthen parallel to the plane of the fracture. It does not supply crude, but milling asbestos. On the whole, the working front is poor in fine asbestos. On the other hand the dump contains some fine specimens derived from the first works which unfortunately have been abandoned for several years.

The other cuttings run parallel to the first and present the same indications, with a larger quantity, perhaps, of milling asbestos, but without many veins of asbestos with fibres normal to the sides.

The finest veins of asbestos are found towards the middle of the island, at the contact with the pyroxene veins. Only a few blasts were set off there and it would be interesting to push these works. Some veins of fine silky elastic asbestos are met, which attain 1 and 2 inches in thickness and certain portions of the serpentine contain in immediate contact with the pyroxenic rock over 40 p.c. of silky asbestos in small parallel veins. This high percentage of asbestos unfortunately diminishes pretty quickly in receding from the contact.

Other prospecting has been done especially on the north side of the island about the level of the pyroxenic intrusion. No veins of asbestos in workable quantity were encountered; only numerous veins of picrolite, which

Mining works as Asbestos Island

to some extent resembles asbestos, but which owing to hardness is unfit for any use.

Workings in the Western Extension of McKenzie Bay.—In a very small island to the east of Asbestos Island, some excavations were made in a white rock of fine fracture, showing under the microscope crystals of pyroxene, garnet and olivine and containing small quantities of asbestos and picrolite in the fractures. In certain spots, the rock presents light green olive segregations, which are crystals of pyroxene. In others, the segregations are of a bright grass green. These are ouwarovite (chromiferous) garnets. This association of pyroxene, serpentine and garnets deserves to be noted.

On the south shore of the western extension of McKenzie Bay (Roy VI, 4) asbestos has been looked for in the compact-black schists similar to those at the east point of Asbestos Island. A vein of serpentine cuts these schists. It is crumpled and distorted; in places it is transformed into long fibre but brittle asbestos. The fibres of this asbestos are very oblique in relation to the walls of the rock. Only a small quantity of milling asbestos could be obtained from it. This serpentine contains some well crystallized geodes of albite.

At a distance of ½ a mile west other workings have disclosed in a pretty hard serpentinous rock, a 4″ vein of calcite on the walls of which is picrolite; but the whole possesses no industrial importance.

The same may be said with respect to the workings met ¾ of a mile to the S. W. of the head of this bay, along a cliff trending E. W. and made up of a fine-grained light grey peridotite, changing in spots into serpentine accompanied by veins of talc without much value.

North Shore of McKenzie Bay.—No work has been done along this shore, which is composed of a dark serpentine traversed in many places by a network of fine veins of asbestos cutting each other at right angles. In general, these veins are not thicker than ⅛ inch, but their network is very close.

Gun Bay.—Three excavations have been made at the water level at a distance of 60′ from each other in a fine grained serpentine showing extremely short, thin veins of asbestos. These veins are parallel and are not more than 2″ to 3″ long. In the planes of fracture, however, schistous pieces accompanied by a little good asbestos, a.. visible. Among the rocks already extracted, some pieces can be seen traversed by a vein of silky asbestos of ⅝ of an inch. I found none of this size *in situ*.

Narrows of McKenzie Bay.—At some hundreds of yards from the eastern shore of the narrows (V 6 Roy) six excavations have been made for asbestos in an impure serpentine traversed by bands of true serpentine. At the contact and in the planes of fracture, a little milling asbestos was found,

In other serpentinous bands, especially at the Hanging Rock of Lake Bourbeau and on the level of 8 VI McKenzie, along the river Asinitchibastat, I found the same indications, namely, a few small veins of asbestos without continuity, both in the planes of fracture and in the faulting of the rock.

On the whole, apart from the workings on Asbestos Island and also, perhaps, those of Gun Bay, no prospecting for asbestos gave me encouraging results. Other prospecting may, perhaps, prove luckier; the northern part of McKenzie bay especially should be explored.

NOTES ON THE CLAY IN THE LOWER PORTION OF THE CHAMOUCHOUAN

From St. Félicien to the foot of the Piémonka rapids, the banks of the river consist of horizontal beds of clay and arkose.

A sample of clay taken from a cliff 25 feet high along the Rivière aux Trembles, a mile from its mouth was analyzed in the laboratory of the Polytechnic School with the following result:

Loss by fire	1.75
Total Silicon	62.55
$Fe_2\ O_3$	2.07
$Al_2\ O_3$	23.23
Ca O	4.12
Mg O	2.94
Alkalis and undetermined	3.34
	100.00

Two briquettes were made with this clay and the shrinking from dessication gave 5.5 p. c. in one case and 6.1 p. c. in the other.

These briquettes were subjected to a first baking of one hour at 900° and yielded a yellow, slightly reddish product, hard, sonorous, without a fissure or crack.

A second hour's baking had no effect on one of the briquettes. In the other a wide fissure was developed which must no doubt be attributed to too prolonged a baking.

The latter briquette, on being broken, showed a fine paste without apparent grains of quartz, but containing some small holes due to defective kneading.

The quality of the products thus obtained by means of quite rudimentary processes enables us to state that this clay might be used for the manufacture

Result of an hour's fishing on Lake Chibougamau

of ceramics (bricks, tiles, squares, pipes). The colour after the baking, is very pleasing, the grain is fine and the hardness considerable.

RAILWAY

With regard to the construction of a railway to connect Lake St. John with the Lake Chibougamau region, it is difficult for me to give a positive opinion. The study of such an undertaking necessitates the sending out of a party of engineers and surveyors who do not go through the country solely in canoes as we had to do owing to the short time at our disposal.

Certain points may however be laid down :

1. The construction of such a railway would not present great difficulties. The country is not very much broken and there are no deep valleys to be got over by artificial works. The ground rises without steep slopes to the line of the water-shed which is only 975 feet above the level of Lake St. John, say an average of 8½ feet per mile in a straight line.

2. Such a railway would rapidly open up to colonization a very fertile region which, on a width of about 35 miles, stretches from Roberval to the foot of the Piémonka rapids. The soil there appears as excellent as around Lake St. John and when the first clearings are made, the conditions as regards farming will be the same as at Lake St. John. Unfortunately those favorable conditions disappear after the Piemonka rapids. Some good land is found, however, towards the delta of the Nikabau river.

3. There are extensive reserves of pulp wood especially towards lakes Nikabau, Jourdain, White Fish, Obatogamau and around lakes Bourbeau and Doré. Lumbering could be carried on profitably there from the very opening of the line.

4. A railway that would run not very far from the valley of the lower Chamouchouan and from that of the Chigobiche would render the utilization of many water-powers possible : the falls of St. Felicien, Portage de l'Ours, Chaudière (100,000 H. P.), Vermillion (9,000), Gras (4,000) ; one of these falls moreover, could furnish motive power for the railway itself and it would be probably economical to use electric traction owing to the distance from which coal would have to be brought.

5. Considering the great area of mineralized lands in the Chibougamau district, it may be said that the indications found so far are very promising as regards the development of that region. From this standpoint a railway is very desirable for it alone will permit a thorough study of the region and the utilization of the riches it contains.

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		4 samples or less at one time each	More than 4 samples at one time each
Gold		$1.00	$0.90
Silver		1.00	0.90
Gold and silver		1.00	0.90
Copper		1.00	0.90
Lead		1.25	1.15
Zinc		1.50	1.35
Nickel		2.00	1.80
Arsenic		2.00	1.90
Manganese		2.00	1.80
Chromium		2.00	1.80
Antimony		2.00	1.80
Bismuth		2.00	1.80
Silica		1.00	0.90
Iron (metallic)	smelting	1.00	0.90
Phosphorus	quality of	2.00	1.80
Titanium	iron ores	1.50	1.35
Sulphur		1.50	1.35
Alumina		1.50	1.30
Ferric oxyde		1.00	0.30
Lime		1.50	1.35
Magnesia		1.50	1.35
Graphite		1.50	1.30
Moisture		0.25	0.25
Combined Water		0.50	0.50
Insoluble Matter		0.50	0.50
Identification of minerals		0.25	

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